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LIGHT ✦ HEAT ✦ POWER ✦ BYE-PRODUCTS

[Founded in 1849 as the "Journal of Gas Lighting."]

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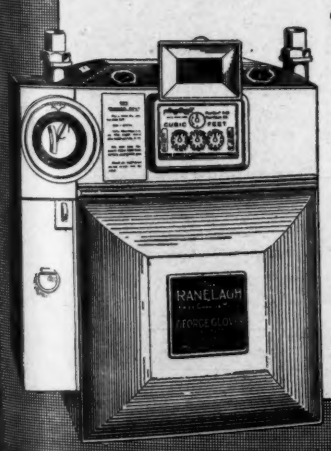

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VOL. CLXIV., No. 3158.] WEDNESDAY, NOVEMBER 21, 1923. [75TH YEAR.

EDITORIAL NOTES.

Our Part at Wembley.

OVER that vast acreage of ground at Wembley where next year all the glories of the industries of the great British Empire are to be displayed, huge buildings are being constructed, and gas, electricity, water, and other systems are being laid down on a scale and of a structural character which will make the old White City nothing more than a miniature of what will be here. It is a magnificent attempt to demonstrate the modern progress of our colossal industries in the service of the people and the amenities of life, and in contributing to our activities, prosperity, and general well-being. The conception was Imperial; the general scheme and all it comprises are of the same order. So gigantic is it to be, that London itself could find no suitable place for it; and so accommodation had to be secured on its outskirts—accommodation in a place readily accessible from the Metropolis of the British Empire. It is no London show; it is not for the benefit of London only. Its wonders and splendours will constitute a great magnet, which will draw people from all parts not only of this country, but from our Dominions, and, in fact, from all over the world. It has our Government and the Dominion Governments behind it; and it will be advertised in no miserable manner not only in this country, but throughout the Dominions. The scheme of publicity, as we have heard of it, is to be of a character that has had no equal in this country's methods of telling of what she is capable. The managements of the great transport systems are making special arrangements to link Wembley with everywhere, and are scheming, or have schemed, special facilities. Reduced fares and excursion trains are being arranged to enable all who can to pay a visit, and inspect the results of our modern industrial life. The authorities of every city and every town of importance in Great Britain will see to it that nothing will be lacking on their part to make the exhibition the trade stimulant and educational influence that are the reasons for bringing it into existence.

Gas must be there. It is a matter of prestige, a matter of honour, that it should be. And not only so, it is a duty, and important to our interests, to let the whole world know, in what will be a setting never before equalled in this country, of the progress in service that the gas industry has made. It cannot show the progress effected in its manufacturing plants and processes; that would be too great and too costly a scheme, and the results might not justify the enormous outlay that would be necessitated. But it can demonstrate the remarkable progress there has been in the service to the people, in homes and industries, of gas and the secondary products of coal carbonization—progress in efficiency and in the elongation of the range of applications. Ideas have changed in the gas industry, and for the better, because they disclose a recognition of the fact that the maintenance and expansion of its trading is fundamental to its stability and development, and upon this depends its prosperity in every section. In our view, there has been wisdom on the part of those who are the moving spirits in the co-operative display gas is going to make in concentrating upon the industry's success in the applications of gas and the secondary products. Our electrical friends and rivals in business will be prominently in evidence. They are going to provide the general lighting of the exhibition with a special generating plant, upon which scheme and on the general exhibit of electrical plant something like half-a-million of money is being expended; and the Electrical Development Association are out for £50,000 to demonstrate in a special section the applications of electricity. A network of gas-mains has been laid over the site of the exhibition; and gas will be required by many of the exhibitors in their demonstrations. But the gas industry itself must be there, and will be there, with a good co-operative display—not a display reflecting the products of individual firms, but a display representing the advances made in gas application, no matter by whom. In other words, it is to be a demonstration by the gas industry collectively; and the stronger the co-operation, the more effective will be the display.

It is going to be an expensive matter; but the occasion warrants this. The exhibit has to be made worthy of the industry, and of the imposing company it will be in. The six months' duration of the exhibition constitutes something which has never before confronted the industry in its co-operative propaganda work, and in its endeavours to present to the people and the world a proper picture of its advances. The cost, of course, increases with the duration. It is, however, an opportunity for implanting and spreading in as popular a manner as possible a greater knowledge and recognition of the position of the industry among the other industries and services; and information as to what gas is demonstrating at Wembley must be broadcasted throughout the Press of the land, and through the Press to the people. Many thousand pounds will have to be spent within the exhibition; many thousand pounds will have to be expended outside it. What other industries are going to do on this historic occasion, we must do; and it must be done by the provision of a purse filled by joint contribution. Initial support is very encouraging. There are promises from gas companies, municipalities, and manufacturers of gas-works plant and gas utilization appliances. This form of encouragement is swelling daily; but every gas undertaking and every manufacturing firm identified with the industry, it is hoped and believed, will do its part in making the exhibit and its results all it and they should be. The direct appeal will be coming along shortly. Let the response be of a prompt and a high order. The occasion demands and justifies it.

We cannot publicly speak of estimates yet. Outline plans in every direction have been developed for the Gas Exhibit; and estimates at present can only be more or less approximate. But the Organizing Committee formed from the General Committee have the plans well in hand. They have lost no time since the joint conference of the organizations of the industry—the National Gas Council, the British Commercial Gas Association, the Gas Companies' Protection Association, the Institution of Gas Engineers, and the Society of British Gas Industries—authorized the appointment of a Committee to undertake the work of formulating a scheme, and of seeing it through. We compliment Mr. F. W. Goodenough, the Chairman of the Organizing Committee, and the members of it upon what has so far been accomplished. They have not only worked hard, but good success has attended their efforts. In the first place, the site secured at the exhibition commends itself to us as one of the finest that could have been obtained. The area over all is 12,637 sq. ft. It is in the Palace of Industries, which will be filled with popular attractions; and it is at important cross roads on the main gangway to the Conference Halls. The space has therefore a frontage on two

gangways. The Gas Exhibit will be in good and attractive company, which again is an advantage. Neighbours will be the silk industry, clocks and jewellery, heating and ventilation, pottery and glass, and food. The gas industry's exhibit is therefore well placed. The plan and general design of the exhibit has already been submitted tentatively by the Architect—Mr. H. Austen Hall, F.R.I.B.A.—to the Director of British Exhibits (Sir Lawrence Weaver), who has given it general approval. The scheme is highly attractive in respect of architectural features and detail for satisfying the objects; and those responsible have very wisely kept in the forefront the idea of making the exhibit inviting to the public. For example, in our perambulations of exhibitions, we have often had weary feet; and so have most other people. There has been an ardent longing for a place of rest. Here we find that the first main feature of the exhibit will be a large room or hall entered directly from the main entrance portico. This room will be 100 ft. by 50 ft. between walls; and it is proposed to furnish it as a rest lounge, where visitors may take their ease, but ease amid illustrations of the applications of gas to domestic lighting and heating. It is a little early to publish the details of what it is hoped to include in the attractions of the rest lounge. But we may say that it will be lighted by fittings suitable for a large business salon or public hall; and it will be surrounded by fourteen model rooms, illustrating appropriate lighting and heating for different apartments. There will be a considerable display of novelty here. But these are matters which cannot be talked about at this stage; all we can assert is that they appeal to us as good. In the second half of the interior, a demonstration hall, 100 ft. by 50 ft. (between the walls) is planned in sections to illustrate the applications of gas to (*a*) the lighting of business premises, (*b*) cooking, bread baking, and home laundry work, (*c*) hot water supply for all purposes, and (*d*) industrial processes of many varieties. There will be demonstrations in all these applications of gas. It may, however, be pointed out that much greater space will be devoted to the heating, industrial, and water heating sections than to the cooking section; the opinion of the Executive rightly being that the public of to-day need more education in the possibilities of gas under the first three headings than they do in its use for cooking. The exhibit will be staffed by men and women capable of giving visitors complete and accurate information in an interesting and pleasing manner. This is of considerable importance to the success and productive value of such a large enterprise.

We have said enough, without going into details (which may be subject to revision as the plans develop and materialize), to show that those who have been entrusted with the organizing of this important demonstration are going to make it worthy of the industry, and give to it a distinctive place in the great display. To the Gas Exhibit, there will be pendent engagements. For instance, the provisional programme incorporates a Public Conference on "The Place of Gas in the Life of the Empire," and a special conference of architects and builders on "Gas in Relation to the Planning, Design, and Construction of Buildings." Brief lantern addresses are also included; and special literature will be provided, in addition to the extensive plans for advertising.

Much in connection with the detail has yet to be considered, and worked out; but we are sure the Organizing Committee are properly interpreting the wishes of the industry that its representation at the British Empire Exhibition should be well done, and be one of the prominently attractive features in the great display. That it will be so, there can be no doubt if the constituent parts of the industry throw into the scheme their whole weight. The opportunity for doing this is near at hand.

Therm Standard Price Revision.

THE first inquiry into the revision of therm standard prices has been held; and a very tame affair it proved to be, for the simple reason that between the Gas Light and Coke Company and the London County Council there was practically only a question of principle involved. But this is a matter of considerable importance to all gas undertakings whose standard price is in question; and therefore it will be a good thing to have it settled once and for all, because it is a point which will occur in varying degree with all gas undertakings. In the first place, we are pleased to notice that the parties concerned were not disposed to make of this a big contest; and when the Director of Gas Administration (Mr. H. C. Honey) faced the contending parties, he found that Mr. Rowand Harker was appearing for the County Council, and Mr. Jacques Abady for the Company, with Mr. Arthur Valon and Mr. D. Milne Watson (Governor of the Company) respectively as the only witnesses—other than Mr. W. R. Herring, who was the sole representative of the Ilford District Council. This gives a good lead to economical inquiry; there is no necessity for making an expensive matter of a question of standard price revision. All that the Director of Gas Administration wants is to have the facts and arguments before him.

There was no difference of opinion as to the fairness of the standard price being reduced in the changed circumstances as to costs. The Gas Light Company were the first to have a therm standard price fixed under the Gas Regulation Act; but in declaring dividends they have not taken advantage of this fact. The only disagreement was as to the amount by which there should now be reduction. One must not be led astray by the fact that disagreement may only represent a fraction of a penny per therm; that fraction may mean a good deal to the proprietors should uncontrollable costs unfortunately ascend. In this case, the County Council submitted that the revision should be to 10·8d. per therm; the Company held that 11·4d. was the proper figure. The point of principle was that the Company are entitled to have credit, in fixing a new standard, for any improvements they have made which affect costs apart from costs over which they have no control. This was well put by Mr. Abady, when he said: The real inquiry was as to what alteration there had been in the cost and charges of, and incidental to, the production and supply of gas "from circumstances beyond the control of, or which could not reasonably have been avoided by, the undertakers." In other words, the measure of the reduction is not necessarily to be found by a mere comparison of present-day actual or estimated costs and the costs for any previous period. Some part of the reduction in cost may be due to circumstances within the control of the Directors—such as improved processes of manufacture. The Company's case was that such portion of the reduced costs could not be taken into account by the Board of Trade in fixing a lower standard price. We hope that, in giving his decision as to the amount of the reduction that is to be made from the 15·2d.—the present standard price per therm—the Director of Gas Administration will give some guiding intimation as to the point of principle submitted by the Company. To our mind they, and all gas undertakings working under the sliding-scale, are fully entitled to credit in the standard price for any improvements in costs they are able to effect apart from costs uncontrollable by them, in order that there shall be participation by the proprietors in any gains arising from good management.

Street Lighting Policy and Electricity Trading Illustrated by Bath.

THERE has of late been a considerable revival of consideration in municipal council chambers of the question of street lighting. If we set aside the cases of expiring contracts, it is found that there is only one reason for the present outburst of attention; and it is the old one of municipal trading in electricity, and a desire to give to the electricity undertaking more business—generally at the expense of the ratepayers. In some instances, proposals are being discussed for the conversion to electricity of all gas-lamps in the administrative area; in others, the plans for conversion are of a progressive, piecemeal character, to suit the circumstances of the electricity concern. Where there is not municipal possession of the electricity supply, any question of change very rarely arises. Now we maintain that to allow municipal trading in anything to dominate what should be the first principle in local government—namely, administration with efficiency and economy—is wrong; and municipal councillors are as well aware of this as we are. In other words, the fundamental obligation of municipal councillors is to administer, on behalf of the ratepayers, the local affairs with care in respect of outlay, combined with efficiency. But there is a proneness to evade this obligation in connection with street lighting, and to give the interests of the electricity undertaking precedence over those of the ratepayers. Yet, whatever else is required in the public service is very properly put up to tender; and, providing the value is right, the lowest tenderer naturally gets the work. But

street lighting has come to be an exception to this general and salutary rule, owing solely to municipal possession; and more the pity! There seems, in fact, to be a strong reluctance in some quarters to expose the municipal electricity concern to competition for the street lighting with the local gas undertaking, if company-owned. It appears to be so—in fact, we may say it is so—at Bath, where the paring-down of the street gas-lighting has commenced; but it is to be hoped the councillors will not allow it to continue, unless the electricity undertaking can offer the ratepayers the same value as the Gas Company for the same money. We must admit that the electricity undertaking has a low-priced competitor to deal with; but the stronger the reason why the interests of the ratepayers as a whole should not be sacrificed to those of the electricity concern. The fact that the Gas Company are to-day supplying the citizens with gas at a price which stands in the forefront of low gas charges in this country, instead of being regarded by the City Council as something meritorious, and something which should ensure the Company a fair field and for its competitor no favour for any business that is going, appears to be looked upon as a good reason for putting about the electricity undertaking the municipal palladium.

We will briefly refer to what is happening in the city, and also deal with some of the illogical arguments that were advanced in the Council. The Gas Company supply 1140 street lamps, 1110 of which are extinguished at midnight, and 30 kept alight all night. The extinguishing of such a large number at midnight was resolved upon for economical reasons—the odd 30 being kept alight at dangerous crossings. The Electricity Department light about 1100 lamps, all of which are kept alight all night, without any regard for position or necessity; the argument being that the electricity after midnight does not cost anything! If this is really the case, then the electric lamps should only be charged for on midnight terms; but the fact is the Department are paid for them on the all-night scale! From this there can be no question that, while economy was sought and obtained through gas lighting, there was a studious consideration for the financial assistance of the electricity undertaking—public necessity or convenience and expense being matters of secondary importance. Now on the recommendation of the Street Lighting Committee, the Council have agreed to the conversion of a further 171 gas-lamps, notwithstanding a very tempting offer by the Gas Company. This, it was made clear at the Council meeting, is only the beginning—the beginning of a vicious policy which deliberately bars competition for a public service and, it may be said, permanently denies the ratepayers the advantage of all control that such competition gives to expenditure upon public lighting; and this without any regard for efficiency. Once get the street lighting completely into the possession of the Electricity Department, and there will be no possibility of going back—however cheaply and efficiently the service could be rendered by the Gas Company, whose ostracizing sin (in this matter) is that it is a good example of private enterprise and not of municipal adventure.

In view of the plan to commence to convert the current public lighting holding of the Gas Company, they presented new terms to the Council; and this act has been the means of giving us one of the worst illustrations we have ever had of municipal disregard for hard facts and the interests of the ratepayers in the matter of public lighting, where a municipal electricity concern interposes itself into the consideration of policy in connection with local administration. In fact, we see here that the electricity undertaking can no longer compete on ordinary commercial principles, and so the proposed change has to be frankly and stubbornly defended on the senseless ground that the policy of the Council is to effect conversion to electricity—no matter the cost to the ratepayers—in order that there may be patronage of their own "shop," although another "shop" may be able to supply at a lower price. Did ever a business man who required material in his own business buy from himself when it cost him more than he could secure it for from another source? There are apparently some councillors on the Bath City Council who need educating in the rudiments of business economy. The Gas Company offered to supply the present lamps on midnight lighting at £2 9s., instead of £2 18s. 9d.; and lamps on all-night lighting at £3 3s. against £3 13s. 6d.—the only stipulation being that the present number of gas-lamps be maintained. This would effect a saving of £550 in the annual cost of public lighting. But there is another proposition, which would—mark this!—avoid all the cost of conversion, and would produce still greater economy for the ratepayers. It is that, if the Council will use gas for all the public lighting, the Company are prepared to reduce further the charges for public lighting to £2 5s. for midnight lighting, and £2 19s. for all-night lighting. This, after allowing for the hire-purchase of the lanterns on a ten years' basis, would effect a saving of £1180 a year. We have seen that the electric lamps—whether in important or unimportant places—are kept alight all night; so that the policy applied to gas is not applied to municipal electricity. The lamps—chiefly electric—kept alight all night number 1130; and these could be brought down to 500, which would further reduce the cost by £440—making the total saving per annum £1620. The gas-lanterns, burners, governors, &c., would be the property of the Corporation at the expiration of the ten years, and as they should be in good condition for further service, the annual saving would be increased by 8s. per lamp per annum. Let us emphasize this, that the saving is net, after allowing for the 8s. per gas lantern per annum paid by the Corporation on the hire-purchase system. But that saving is to be rejected, *plus* the cost of conversion to electricity and *plus* the liquidation of the balance of the cost of the gas-lanterns, in order to benefit not the ratepayers, but the electricity undertaking. Is this wise? Is it administration with economy and efficiency? The questions need no answer.

But Sir Harry Hatt, at the Council meeting, in what he intended to be a destructive criticism of the Gas Company's proposals, was superbly illogical, and very feeble was his attempt at defending what he described as the "policy" of the Council in gradually transferring the custom of public lighting from gas to their own electricity establishment. Even though that may be the "policy" of the Council, the fact does not prove that it is a right policy; and anyway a mistake in policy is not irrevocable. Sir Harry protested that the adoption of the Gas Company's proposals would involve a variation of the existing agreement. But what matters that, if economy is to be secured for the ratepayers in the provision of a public service? He also declared that the change would tie the Council for some years to the existing number of lamps. This is incorrect, inasmuch as the present agreement can be determined by six months' notice—the only obligation upon the Council being to find the balance of the hire-purchase money for the lanterns, of which they can make the best disposal possible. Then there came the point that, if the Council agreed to the Gas Company's proposals, they would lose the whole of the profit made by the electricity undertaking. The profit on what—the public lighting? And the profit made from whom—the ratepayers? This profit-making from the ratepayers for the electricity undertaking is to be continued, at the loss of the saving which the Gas Company offer to effect. The ratepayers would gain more from the saving than the profit. Nothing more is wanted to show how politic local administration is immolated on the altar of municipal trading. We hardly like to mention, with the facts of the position before us, the submission of Sir Harry that he did not suppose any other business undertaking would go outside to purchase anything when it could be obtained from itself. We have already touched incidentally upon this point; but let us here ask Sir Harry the direct question—whether he knows of any commercial undertaking, run by competent business men, that would supply itself with a commodity or service produced inside which could be bought at a lower price outside? Administration of a municipal trading undertaking appears to have rather a destructive influence on sound reasoning. Then, again, the defender of patronage in the dearest market does not approve of asking for tenders from the Gas Company and the Electricity Department for the whole of the public lighting; but, as we understand him, he prefers to pursue the policy of conversion of the lamps without reference to the economic interests of the ratepayers. He infers—in fact he says—it is quite obvious the Electric Light Committee could not tender for the whole of the street lighting. This is surely an admission that the Gas Company have out-run the Electricity Department in the matter of ability to compete for the street lighting.

We can go farther in the criticism of Sir Harry Hatt's arguments. He accuses the Gas Company of looseness in their figures; those figures look pretty solid in our eyes. But what of his own looseness? He states that the taking-over of 171 gas-lamps will be putting money into the rate-

payers' pockets. Let us see. The approximate cost of lighting at present is: Gas, £3370; electric, £4290—total, £7660. The offer of the Gas Company to reduce their prices if the 171 lamps are retained by them would have resulted in this: Gas, £2814; electric, £4290—total, £7104—a saving of £556. As the Council have decided to convert the 171 lamps to electricity, the price per lamp remains as at present. The cost of lighting will therefore be: Gas, £2868; electric, £4816—total, £7684. Therefore, instead of putting money into the ratepayers' pockets, it is quite obvious that it takes £580 out of them. The accuser of looseness, we think, himself stands convicted of it. As previously demonstrated, the terms upon which the Gas Company could do the whole of the lighting would effect a very considerable saving.

Just one other point. At the Bath City Council meeting a good deal was said regarding Liverpool which was not quite correct. One member of the Council stated that the gas and electricity undertakings at Liverpool were both municipal. It may be as well to state that this is not so, but that the gas undertaking is a private company and the Corporation own the electricity undertaking. In that city, there are 498¾ miles of roadway lighted by gas, and only 18½ miles by electricity. But the satisfaction of Liverpool with gas lighting is shown by the fact that year by year they have been fitting more controllers to the gas-lamps for lighting and extinguishing. This work is still going on, so that manifestly there is no intention there to convert further gas-lamps to electricity. At Liverpool, the ordinary price per therm for gas is 7·4d.; and the charge for electricity for public lighting is 3·3d. per unit. At Bath, the ordinary price of gas per therm is 5d.; while the charge for electricity is 7d. per unit. Thus the ordinary price of gas in Liverpool is 2·4d. more than at Bath, and electricity is less than half the price charged in Bath; and yet the Liverpool City Council have 480 miles of roads lighted by gas in excess of the mileage lighted by electricity.

A policy that ignores economy is against all the best traditions of British local administration. We are sorry to see it; and it is a matter which ratepayers should not only deplore, but seek to remedy.

Rubber Joints for Gas-Mains.

An article of unusual interest appears in this issue from the experiences and research of Mr. Walter Hole regarding the use of rubber as a flexible jointing for gas-mains. *Primâ facie* one would say, as many gas engineers have said, that rubber would be neither suitable nor durable for such a purpose; but this would be, as it has hitherto been, an opinion based upon pure hypothesis, and not upon practical experience. Now Mr. Hole presents a case—founded on long years of experience by himself and other engineers, as well as on chemical and other tests—which proves that sufficient attention has not been given to this matter, and that assumption only is an erring guide in respect of it. As our remarks have indicated, the use of rubber joints for gas-mains is not a new one, but it is a little-known practice; and yet there are isolated experiences in this country and in France which show that rubber joints have for periods running to over forty years been efficient and satisfactory, and have saved a lot of trouble that would undoubtedly have otherwise occurred. In one area, too, in which Mr. Hole was the Gas Distributing Engineer (it would not tax us much to determine that area), there was a district undermined by colliery workings; and great trouble with the gas-mains was caused by subsidences. He tried rubber joints in that district; and the results were immediately beneficial and absolute. Some of the mains were laid with the rubber joints twenty years ago and others eighteen; and there has never been a case of escape, a drawn joint, or fractured main on that section during the whole of the time, and not a single penny has been spent on repairs. That is excellent testimony. This, combined with other experiences recorded in the article—particularly those in France—will give engineers having charge of mains in districts that are affected by underground workings good ground for considering the adoption of rubber jointing.

Searching experiments, supplementing experience, have been carried out by Mr. Hole by subjecting different samples of rubber to the action of petroleum, benzole, toluole, and solvent naphtha. The results are mentioned in the article; and it will be seen that, as with most other commodities, there is rubber and rubber. There is rubber that is more suitable for this particular purpose than other rubber, which points to the fact that, if one wishes to gain all the satisfaction and economical result which rubber joints have given to those who have used them, care must be exercised in obtaining *ab initio* the right material. Mr. Hole, not content with his own experiments without the best support available, submitted to the National Physical Laboratory a rubber joint ring which had been in a gas-main for 46 years. The life alone is sufficient evidence; but there is a suggestive paragraph in the "N. P. L." report which may lead people to ask whether modern rubber would have the same lasting effects as the rubber made under less exacting conditions of a past day. The report says: "It is not possible "to state why this ring has lasted so well; but it may be "suggested that the less intimate mixture of the rubber "and sulphur at the time the material was made may lead "to a material which less readily hardens from the slow "action of the free sulphur generally present" If rubber joints become the vogue in districts where there is trouble from subsidences, there would be no reason why, if the modern rubber is not so suitable as the makes of half-a-century ago, there should not be a special make of rubber jointing for the purpose—by reverting, if need be, to the physical characteristics of the rubber that has given such good account of itself for this purpose. Whether or not there is anything in this cannot be stated positively; but, anyway, there can be no insuperable difficulty to making provision of material that will repeat the good experiences which Mr. Hole records.

The Largest Spiral-Guided Gasholder.

Northern Ireland can now boast of having in working the largest spiral-guided holder in the world—thanks to the enterprise of that ever-progressive body the Belfast Corporation Gas Committee, and the wide confidence they have in their gifted Engineer and Manager (Mr. J. D. Smith, M.Inst.C.E.). In the matter of capacity, spiral-guided holders have moved forward somewhat leisurely, though the system has had such large trial in holders of the lower capacities, and under a diversity of stress conditions reaching from normal to the most critical experienced. Mr. Smith is an Engineer blessed not only with ability, but with an abundant faith; and a long experience with spiral-guided holders in Belfast and elsewhere convinced him that it was only a question of adequate design to remove safely the magnitude of spiral-guided holders to any desired higher capacity. With the sanction of his Committee and the City Council, his belief finds expression in the fine holder, the construction of which the members of the Institution of Gas Engineers had the privilege of inspecting at their last annual meeting, when Mr. Smith was President. We look upon this holder as marking a new record in gas-engineering work. It has brought the spiral-guided type of holder closer up to those column-guided ones that are of the first magnitude, but the number of which is small that exceed in capacity this four-lift 7 million c.ft. spiral-guided one. This capacity about doubles that of the largest of the holders of this type previously erected. The advance will make the competition the keener between the two common types of construction, and later on possibly between them and the tankless form of holder. We are now escaping at good rate from the more or less conventional modes of holder design. However, this new spirally-guided mammoth was inaugurated last Wednesday; and Mr. Smith is to-day working with the comfortable knowledge that he has at command storage equal to twenty-four hours' maximum demand. But with the current progress of requirement, it is very much a matter of guesswork as to when the maximum demand will again exceed storage capacity to such an extent that the latter will need further addition. At the inaugural luncheon, there was recognition—richly deserved—of the work of the Engineer; and the expeditious and careful manner in which the Contractors for the holder, Messrs. R. & J. Dempster, Ltd., had carried out the structural work also received praise, and from men who are capable judges of engineering performances. Completion in ten months, with the arresting of operations to afford an opportunity to the members of the Institution of Gas Engineers to make inspection, is excellent work. The fact that the holder, fully inflated, has operated as steadily in the recent great storms as it does in calm weather, is good proof of the soundness and accuracy of both design and structural work. Upon this there may be hearty congratulation of both the Engineer and the Contractors.

Nationalization.

Politically, the "JOURNAL" is absolutely neutral; industrially, it has to take into consideration all matters which affect the interests it serves. A capital levy and nationalization are among such topics; and those are proposals that stand in the forefront of the Labour Party's "Appeal to the Nation" to enable them to adopt a policy of plunder and nationalization of industries. Neither industry nor the nation at large can afford to have its capital or its sources of capital violated, even on a vague promise of a reduction of income-tax. As to the nationalization of mines, railways, and electrical power stations, we had a taste of Government control during and subsequent to the war. No industry wants to see intensified the condition of things that then existed—particularly in connection with industries that play an important part in the life of the nation. At all events, the gas industry will not desire to see its means of transport and its coal supplies under Government control; and we have little doubt the electrical industry will record at the General Election a solid vote against the nationalization of its power stations.

Unemployment Relief Schemes.

Some of the objections of gas companies to the terms relating to Government assistance in connection with unemployment relief schemes, have not yet been met, despite pressure from the Central Executive Board of the National Gas Council. Sir Montague Barlow has promised to give careful consideration to alternative suggestions made to him by the President of the Council (Mr. D. Milne Watson); but we are afraid there is little hope of any immediate settlement, in view of the dissolution.

Refractories Research.

In our "Correspondence" columns to-day, is a reply by Mr. A. E. Broadberry, Chairman of the Joint Committee on Refractory Materials, to the criticism by Col. C. W. Thomas and Dr. J. W. Mellor of the remarks he made at the Belfast meeting of the Institution. We hope that our friends of the Refractories Research Association will take Mr. Broadberry's reply in as good spirit as he has accepted their criticism. This little "bout" will, it is hoped, have an excellent influence upon the relationships of the Institution and the Association.

The Rating and Valuation Bill.

The Council of the Association of Municipal Corporations are an influential body. They have given, in a letter addressed to the Secretary of the Ministry of Health, strong support to the main principles of the Rating and Valuation Bill, although not yet able to submit their proposals as to matters of detail. The Association and the municipalities whom they represent have for many years past urged upon the Government the necessity for legislation with the view of doing away with the anomalies and inequalities of the present rating law, and placing the whole system of valuation and rating on a sound basis—thereby avoiding the undue expenditure inseparable from the present procedure, and securing uniformity and fairness as between one ratepayer and another. The Association express the hope that the Government will at the earliest practicable date take active steps to secure the passage into law of a Bill embodying the main principles of the present draft one. The National Gas Council are studying the draft Bill from the point of view of the gas industry.

A Tariff Committee.

The Prime Minister has appointed a Committee under the Chairmanship of Viscount Milner, "to advise His Majesty's Government in connection with the preparation of the proposed duties on manufactured goods." The makers of lamp and laboratory glassware and gas mantles and fittings will be particularly interested in the work and report of this Committee.

The Miners' Agreement.

The Miners' Federation and the Mining Association have decided to appoint a Sub-Committee of seven from each side to hold a full inquiry into the position of the coal industry. This is an outcome of the proposals of the Miners' Federation for a revision of the national wages agreement, which were the subject of a conference last week. The owners then announced that they could still not agree to the suggestions put forward; but they desired the appointment of a Joint Committee for the purpose mentioned above. This suggestion was accepted.

PERSONAL.

Mr. P. C. HOLMES HUNT left England by the "Berengaria" for New York. He is spending about a month in the States, before returning to Australia.

Mr. J. P. LEATHER, who has been Gas Engineer and Manager for the Burnley Corporation since 1889 (having succeeded his father, who had held the position for 26 years), tendered his resignation to the Gas Committee, and it was accepted, at a special meeting held last Wednesday night. In recognition of his services in reporting upon and preparing plans for the new gas-works, the Committee have decided to recommend the Council to make him a payment of £250. Mr. Leather, who has had a very successful career at Burnley, will retire early in the new year to Letchworth; and it is probable he will take up work as a Consulting Engineer. It has been decided to advertise for a successor.

It is with pleasure we learn that Mr. ALBERT CLIFF, J.P., Managing-Director of Williamson Cliff, Ltd., has been elected Mayor of Stamford for the third time.

Mr. F. H. HOLLAND, who is well known in the gas industry in connection with the efficiency work of the "B.C.G.A.," has commenced private practice as a consultant and adviser in the same line. Communications should be addressed to him at No. 162, Stapleton Hall Road, London, N. 4.

OBITUARY.

JAMES HUTTON.

A wide circle of personal and business friends will regret to hear that Mr. James Hutton, Chairman and Managing-Director of Messrs. Alder and Mackay, Ltd., gas-meter manufacturers, died on the 16th inst. He was attending to business as usual up till the end of the previous week, when he was removed to a nursing home, and underwent a serious operation, with fatal results.

Mr. Hutton, who was a son of the late William Hutton, Clerk of Works, Edinburgh, entered the service of Messrs. Alder and Mackay 42 years ago; and during this period he saw great developments in the business, in which he took a very active part. Under his able guidance, the new works at Douglas Street, London, were completed; and extensions to the present New Grange Works, Edinburgh, are in course of construction.

Mr. Hutton's business ability and unfailing courtesy were widely recognized throughout the gas industry, in which he was personally well known and greatly liked. He was Chairman of the Cowdenbeath Gas Company, Ltd., and of various other gas undertakings. Deceased leaves a widow and one daughter.

The funeral of the late Mr. GEORGE WOOD, for nearly 50 years the Manager of the Maidenhead Gas-Works, took place at the

Parish Church, Taplow, on Wednesday last. Mr. Wood, who was in his 73rd year, survived his wife by barely two months; and the sad loss that the family have sustained has awakened much sympathy in the town and neighbourhood. The crowds of reverent people who followed the cortège from the house to the graveside testified to the esteem and respect in which the deceased was held by all.

A well-known figure in the life of Liskeard, Cornwall, since 1887 has passed away, in the person of Mr. WILLIAM COWLING, the Manager of the gas-works.

ELECTRICITY SUPPLY MEMORANDA.

OVER a long course of years, many electricity undertakings could be counted which have had their little experiments, and unhappy experiences, in attempting to do business in small houses, where the consumption of electricity is also small, and the outlay in giving the supply is out of all proportion to that incurred in providing a service in houses in which consumption is of a more generous order. Some undertakings have found it advantageous to decline to extend the scheme of providing wiring, fittings, and a prepayment meter, inasmuch as the sum per unit added to cover capital, maintenance, office, and collection charges does not provide sufficient, even with the "profit" on the current consumed, to justify a continuation of the system. In fact, there have in some cases, where the prepayment consumers are of the working class, been actual losses; and the revenue from the ordinary consumers has had to bear the brunt of these. In other cases, too, it is found, while some of the consumers do provide sufficient revenue to pay for the service rendered, others do not; so that on balance there is nothing left from the aggregate of this part of the business. Then there are the schemes for supplying small householders at a fixed price per light or per week, under which the consumers have a way of developing consumption—however honest they may regard themselves—at an alarming rate. There is no measurement check on them; and, in the circumstances, carelessness in use becomes a habit.

Supply of Small Property.

As has recently been shown in the "Memoranda," there are several undertakings the managements of which are not satisfied with the experimental experiences of others, and want to have a flutter on their own account. Of course, one must admit that the earning and spending power of the residents in small houses varies largely in different districts; and therefore the experiments in one area may not reflect the results that would be obtained in another. But admitting this, a consideration of conditions should alone bring conviction that the results of speculation by electricity undertakings in giving a service to small property occupied by the working class, cannot be particularly lucrative when the total costs are taken into account. The experiments that are now being indulged in by some undertakings run into an expenditure of several thousand pounds. They mean to do the thing properly, and hang the expense! But the greater the initial outlay, the larger the loss—should one come, as there is every prospect it will. The Sheffield City Council have now decided to embark on an expenditure of £10,000—purely as an experiment—in installing electricity in working-class houses. There is no secrecy about its being an experiment, or about the uncertainty of the result. Councillor A. J. Ward, in moving the adoption of the scheme at the last Council meeting, said the Committee "hoped" as a result of this "experiment" that it would be possible to extend the scheme. Mr. Councillor Bailey also pointed out that the Committee had made an honest and *bonâ fide* effort to bring electricity within the reach of the working classes; but "none of them could tell exactly how it was going to work out until they had actual experience." The scheme, he added, must be given a trial, and then be watched carefully. The speculative character and the uncertainty are candidly acknowledged; but it seems to us that for an experiment the amount the Council have consented to spend shows a prodigal tendency. Only occupied private residences in streets where electricity mains are already laid are included in the scheme; and it is not to apply to new houses in course of erection. But where mains are not already laid, consideration will be given to the necessary extension if a sufficient number of residents make application. The rental to be paid is 1s. per quarter per point, with a minimum rental of 4s. per quarter; and no meter-rent will be charged. For five lights only, the rental will be £1 per annum. The electricity consumed is to be paid for at the rates in force for the time being. An applicant will be required to give a guarantee to pay the rental for at least three years, provided he occupies the premises for that period; and on his placing an order, a deposit of 10s. will be required. The installation will remain the property of the Corporation; and an agreement with the owner of the property to confirm this will be necessary. We are afraid the conditions will be looked at very narrowly by many working-class folk, who will turn down the scheme without further consideration. They do not like obligations of this kind; an inclusive charge per unit would be much more to their liking, although the Sheffield system is unquestionably the fairer, as the large consumers do not pay more rental than the smaller ones.

Experiment and Speculation.

In a recent lecture by Mr. Ernest Stroud, on "Modern Illumination," there was an interesting feature regarding the angles at which light is emitted by gas-filled lamps. With inverted incandescent mantles, one gets excellent distribution of light from all points below the horizontal. This makes such burners particularly valuable both for light effect on the working level and for distribution for general illumination. Mr. Stroud gives data as to light distribution by a 500-watt gas-filled lamp by dividing the lamp into three angled zones of 60°: First, from directly under the lamp, 0° to 60°; secondly, from 60° to 120°; and lastly from 120° to 180°. From 0° to 60° 25 p.ct. of the total light is given; from 60° to 120°, 59 p.ct.; and from 120° to 180°, 16 p.ct. Thus nearly 60 p.ct. of the total light is given off in the mid-zone. With lamps hung in the ordinary manner, the only rays which are utilized for direct illumination of the working plane are those given off between the angles 0° to 60°. The mid-zone rays are only effective for illuminating vertical surfaces—such as walls—and they also tend to produce glare in interior lighting, while rays given between 120° and 180° illuminate anything above the level of the unit—for instance, the ceiling. From the analysis, it is seen that no less than 75 p.ct. of the light emitted from a bare incandescent lamp is wastefully employed. Hence the need for some form of reflector to redirect the rays in a more useful direction.

Distribution of Light from Electric Lamps.

The electrical industry is to be congratulated on the novelty of certain recent propaganda. We have had many illustrations in local carnivals and trade processions of cars demonstrating the domestic uses of gas; and most of them have been prize winners. But this year the Electrical Development Association did better. They got a car, illustrating electric cooking, into the Lord Mayor's procession in London. The cooker was supplied with energy from a battery carried on the electrically propelled car; and cakes were baked during the journey to and from the Law Courts. The British Electrical and Allied Manufacturers' Association went one better when they secured the honour of the presence of the Prince of Wales at their dinner last Thursday evening. His Royal Highness is the President of the British Empire Exhibition; and the electrical industry is taking a prominent part in it. The Prince made an interesting speech; and electricity had a "good Press" on Friday morning. Regarding the British Empire Exhibition, gas will be there. An indication of the plans is given to-day in our first editorial article.

Good Propaganda.

A section of the Labour Party appears to have strange ideas regarding electricity. They favour its municipalization and development in preference to gas. They have no consideration for the fact that gas production and supply employs a vast amount of labour, while electricity is something that is mechanically produced, and, until one gets to the seats of utilization, it gives comparatively little permanent employment. The Labour Party are now advocating the extended use of electricity among the working classes. Again, they do not know much of the uneconomical results of such advocacy—if adopted. A pamphlet, written by Herbert Morrison, has been published by them in which better times are promised for the housewife through the agency of electricity. There is nothing that electricity can do for the housewife that gas cannot do, and far better, and (what is of great importance for the working classes) more economically. The pamphlet is filled with platitudes; and it helps to lengthen the record of wild schemes that have emanated from the Labour Party since the socialistic element obtained ascendancy in its control.

Labour Party and Electricity.

"Electrical Industries" announces that there is a prospect of cheaper electric cookers. This will rejoice the hearts of those central station engineers who are trying to push such cookers against many difficulties. But our contemporary urges that there must not be too much price-cutting, which may remove the profit incentive to improve production and to push sales. It criticizes severely the want of system in respect of repairs and maintenance. Of course, the electric cooker is not the simple thing that the gas-cooker is, in which repairs and replacements can generally be effected *in situ* and cheaply. This is what our contemporary says: "When an element fails in a hotplate or an iron, the user sends the appliance to his contractor, who forwards it to the maker, who sends it to his works, where it is repaired in due course and returned to headquarters, whence it is despatched to the contractor, who sends it round to his customer. All this elaborate performance, with its series of entries and advice notes and invoices and discount calculations, and so on, may relate to a job that involves a few shillings and a few minutes. The trade gets no money out of it; and the consumer gets no satisfaction. Is it impossible to devise anything better?" It ought to be; but electricity is somewhat exacting.

Cooker Prices and Maintenance.

Electrical Imports. The good resolutions of 1914 of the electricity supply industry, that it would not again extend such large patronage to imported electrical products appear incapable of fulfilment. The "Electrical Times" calls attention to the large values of electrical importations this year; and it indicates that some measure of protection would be welcomed by the British makers. Calculating on the statistics up to the end of September, our contemporary estimates that this year the following electrical importations will have been made: Carbons, 5 million rods; glow lamps, 9½ million bulbs; electrical machinery, 4280 tons. Electric wires, cables, and telephones will probably represent £850,000. "Electrical goods and apparatus" correspond to 2¼ millions sterling. Illuminating glassware is not divisible so that each illuminating agent can have its proper allocation; but as to electric glow lamps, the increase is described as rather sensational. In the nine months of 1921, 2·4 million bulbs were imported; in 1922, 4·8 million; and in 1923, 7·2 million—three times the 1921 figure. Prices, of course, are far lower.

The "Safety" of Electricity. Just recently Peter Clarke was engaged fitting a new furnace grate at Jameson's Distillery in Dublin. He was given a lamp with which to work, and which was defective. It was the cause of his death through shock. A boy named Lloyd, aged 13, was killed in the basement at the Coronet Cinema, Cardiff, on Oct. 25, by receiving a shock from a flexible electric lighting wire which caught him under the chin as he passed through a doorway.

NATIONAL GAS COUNCIL.

The Central Executive Board of the National Gas Council met at No. 30, Grosvenor Gardens, S.W., on the 13th inst.—Mr. D. Milne Watson in the chair.

GAS REGULATION ACT—SECTION 10—MAINS OF INSUFFICIENT CAPACITY.

It was reported that the railway companies had objected to the following clause which a certain urban district council were endeavouring to obtain in a Special Order under section 10 of the above Act:

> "Notwithstanding anything contained in any enactment to the contrary, the Council shall not be obliged to give from any main a supply of gas for any purpose other than lighting or domestic use in any case where the capacity of such main is at the date when such notice is served insufficient for such purpose, or if and so long as any such supply would in the opinion of the Council interfere with the sufficiency of the gas required to be supplied by means of that main for lighting or domestic purposes."

At the inquiry in connection with the draft Special Order, it was suggested by the Board of Trade that the question should be discussed between the railway companies and the National Gas Council, in order to arrive at a form of words which would be agreeable to both parties. A conference had since been held between the officers of the Council and representatives of the railway companies, when it was suggested that the clause should be re-drafted, so as to ensure a continuity of supply to existing industrial consumers, and to apply only to applications from new industrial consumers. The officers were authorized by the Central Executive Board to proceed with their negotiations on these lines, and to report again thereon to the Board.

RAILWAY RATES—(*a*) STANDARD RATES AND CHARGES.

It was reported that, acting upon the instructions of the Central Executive Board, the Council had lodged objections with the Railway Rates Tribunal against the "quantum" of the standard rates proposed by the railway companies. The objections of the Council, it was stated, covered all traffics in which the industry is interested.

RELIEF OF UNEMPLOYMENT—GOVERNMENT FINANCIAL ASSISTANCE TO PUBLIC UTILITY COMPANIES.

It was reported that the Council had not yet been able to obtain any satisfactory reply from the Unemployment Grants Committee as to the Government's decision with regard to accepting the Council's proposals in connection with "approved" schemes. The President of the Council had interviewed Sir Montague Barlow, the Minister of Labour, and pointed out that the proposals in their present form would not be practicable of application so far as the gas industry generally was concerned. The President, in submitting alternative suggestions to Sir Montague Barlow, pointed out that it was most desirable that an early decision should be arrived at in this matter, in order to enable the gas industry to undertake schemes for the relief of unemployment this winter. The Minister promised that the Council's proposals should be carefully considered.

In view of the early dissolution of Parliament, discussion of other matters was postponed.

RADIATION FROM HOT SURFACES.*

A Valuable Research on Radiant Energy.

THE publication of the results of research on the effect of the shape and surroundings of a hot surface on the radiation from it, carried out for the Research Committee of the Institution of Heating and Ventilating Engineers by A. H. Barker, B.A., B.Sc., and M. Kinoshita, M.Sc., has been rendered possible by a monetary contribution from this Institution, and by a grant from the Department of Scientific and Industrial Research. This report is in part a résumé of a paper by M. Kinoshita dealing with the mathematical theory of the mutual interchange of heat between two surfaces, or different parts of one surface, each of which is emitting radiant energy, some portion of which impinges on the other surface. Only the results of the mathematical treatment adapted for application to practical work are given; some of the more theoretical matters involved being explained in an appendix, in which the experimental work undertaken to confirm the theory is also described. This monograph, which is written with a pleasing lucidity, treats the subject in a thorough way, and will be of great utility to all interested in heating problems. Consequently, members of the gas industry, which has an ever-extending heating load, will welcome, and take advantage of, the publication of this treatise.

All surfaces on which radiant energy impinges transmit, absorb, and reflect it; the sum of these portions being equal to the total incident radiation. The report deals only with adiathermanous surfaces. In these conditions the net amount of heat lost or gained through radiation by a surface exposed to its action is the difference between that which it loses by emission and that which it gains by absorption. Any portion of the radiation which impinges on, and is reflected by, any surface appears to proceed from that surface, in addition to that which it emits in its own right. The apparent radiant emission is, therefore, the sum of that which it emits in its own right and that which it reflects, and which was originally emitted by other surfaces. Owing to the effect of the reflected rays, the apparent emission is greater than the primary or absolute emission. The investigation described in the report determines mathematically and experimentally the character of the effect which the emission from one surface has on the apparent radiation from the other, and the effect of the radiation emitted from one surface at any point within its range.

The first part of the report concerns the fundamental principles of radiation, precise definitions being given of Stefan's law, the law of inverse squares, Lambert's law, and the configuration factor. The latter is most important in the calculation of heat interchange by radiation. Considerable attention is also given to the effect of the reflection of rays impinging on a surface on the total apparent emission from it. When two elements are in juxtaposition, each radiating heat to the other, the apparent effect on the total emission is marked. Generally speaking, the effect is that the more surfaces arranged so that one receives the radiations from the other, the greater is the apparent emission from each surface. When different parts of the same surface are so bent as to radiate heat from one point to another part of the surface, then it is found that the more deeply it is corrugated the more nearly does the apparent emission approach the "black body" value from the projected area of the front surface. Of course, it is well known that if a hot surface is so arranged as to emit its radiation entirely to another part of the same surface, then the radiation becomes entirely equal to that of a black body. When the primary quality of the surface is highly emissive, the amount which it reflects is relatively small. When, on the other hand, the emissive power is small, it reflects more of the radiation. The sum of the two is constant, whatever the primary emissive power of the original surface.

As a practical example of the foregoing, the report considers the case of the heat radiation from column radiators. These have complicated surfaces. The heat emitted by them passes into the room in two ways—namely, radiation and convection. The emission of heat by convection doubtless increases almost proportionately with the heating surface area. As the columns stand side by side, however, there must be parts of the surface from which the whole of the heat radiation is shielded by other parts, and only a fraction of the original radiation reaches the surrounding space. In any case, where there are more than two columns, a considerable part of the effective heat radiation is bound to be absorbed. The heating capacity of a radiator, therefore, does not increase in proportion to the surface area, especially when the temperature is high. Thus the surface area is not a correct measure of the total emission of heat; and, accordingly, a radiator of high efficiency must be so designed as to lose as little heat as possible by mutual radiation. To give a clear idea of the emission of heat by radiation, some types of column radiators given in the National Radiator Company's catalogue are dealt with in detail in the report.

The general character of this contribution to the science of heating will have been gathered from these notes; and, no doubt, many will be desirous of having first-hand knowledge of this admirable work.

* Bulletin No. 1. Report of the Research on "The Effect of the Shape and Surroundings of a Hot Surface on the Radiation from it," carried out by A. H. Barker, B.A., B.Sc., and M. Kinoshita, M.Sc.

THE UTILITY AND DURABILITY OF RUBBER AS A JOINTING MATERIAL FOR GAS-MAINS.

By WALTER HOLE.

AT the very outset of this article, it may not be amiss to state the circumstances in which the writer was first led to consider the question of the suitability and durability of rubber as a flexible jointing material for gas-mains. Some twenty-five years ago, on taking up an appointment as distributing engineer to a large provincial gas undertaking, having at that time nearly 800 miles of mains, he found that at one part of the district there was a considerable area which had been undermined by a local colliery company. Naturally, subsidences of the subsoil continually occurred, with the result that leakages from drawn joints and broken mains were very frequent. As fast as a leak was stopped in one place, another started somewhere else. For months on end leakage gangs were kept going. The evil was, of course, threefold: (1) Considerable quantities of gas which should have brought revenue to the department were lost entirely. (2) At the same time the costs of maintenance and repairs on this section were exceptionally high. (3) There was the continual fear of accident leading to destruction of property and even loss of life. By a

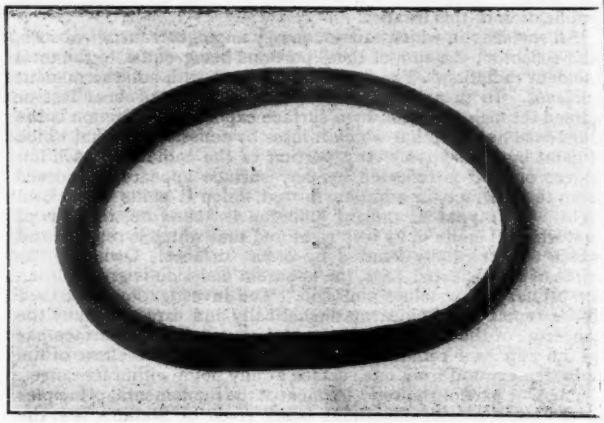


Fig. 1.—Rubber Ring after Use in Ground for approximately Forty Years.

fortunate combination of luck and management, the latter was avoided; but the peril was continually present. Every expedient which experience or imagination could suggest was tried, but without avail. It really began to appear as if the fight between fault and remedy was to be eternal.

Talking the matter over with a friend, who was himself in charge of the distribution of a large provincial gas undertaking, the suggestion was made that rubber joints, of which there were several good types on the market, but of which at that time the writer was altogether without experience, should be tried. Inquiries were made which at first were discouraging. The manager of one rubber firm assured the writer that a rubber ring would disappear in a week if immersed in gas-works liquor. Another said practically the same thing. A leading authority on gas distribution matters told the writer that he would not think of using rubber for such a purpose. Others spoke to the same effect. But the curious fact emerged that none of these gentlemen had ever given it a practical test themselves, and, further, that they were not acquainted with anyone who had. They were not speaking from their own personal experience, or even from second-hand knowledge. Thus, while there was plenty of dogmatism, there was none of that practical acquaintance with the subject upon which alone dogmatism may safely be based.

Persistent inquiry, however, ultimately elicited the fact that at least one large provincial gas undertaking had lines of pipes jointed with rubber rings, which had been down for many years, and had given, and were giving, complete satisfaction. A rubber ring, taken from one of these joints during some alterations, and which had been in use underground for approximately forty years, was sent to the writer. This is shown in fig. 1. It still retains its resilience, and, except for having taken a permanent set of a more or less oval cross-section, appears to be little the worse for wear—notwithstanding its sixty years or so of life.

On placing the facts before his Chairman and Committee, the writer obtained sanction to make a practical test for himself. About 150 yards of main in the worst part of the affected area were taken up, and pipes with rubber joints substituted. The result was immediately beneficial and absolute. So much so that a couple of years later a further and much larger section of the troublesome main was displaced by similarly jointed pipes. It sounds almost like a fairy tale, but it is absolutely true, that from the time these mains were laid, now twenty and eighteen years ago respectively, up to the time of the writer's retirement eighteen months ago, and most probably up to the present, there has never been a single case of escape, or drawn joint, or fractured main on these sections; and not a single penny has been spent on repairs. A photograph of the rubber ring used on this last section is shown in fig. 2 A; as far as the writer is aware, it is made of the composition known as "A" grey rubber—a standard very well known throughout the trade, and containing a high percentage of rubber. Fig. 2 B, shows a similar ring for a larger gas-main used at Lyons.

With a view to elucidating the power of rubber to resist the solvent action of the gases ordinarily distributed by gas undertakings in this country, the writer has recently carried out some experiments of a rather searching and prolonged character.

It is obvious that such resistance will depend primarily upon five factors—viz.:

(1) The character of the rubber composition used.
(2) The degree of vulcanization to which it has been subjected.
(3) The precise action to which it is exposed.
(4) To what extent the rubber is prevented from expanding, owing to the type of joint used.
(5) The general conditions under which it is used.

For the purpose of the tests, three samples of rubber were taken. The first was a sample of pure Para rubber; the two others being rubber compositions usually sold for jointing mains and supplied by a London firm of the highest repute. The exact compositions of these were communicated confidentially to the writer, and he is therefore not at liberty to publish them. It will be sufficient for the present purpose to designate them Q.M. 2 and Q.T. 7, and to say that, while they both consist mainly of the same constituents, these were in varying proportions, while each contained a small percentage of constituents absent from the other. The rubber compositions of both Q.M. 2 and Q.T. 7 grades were

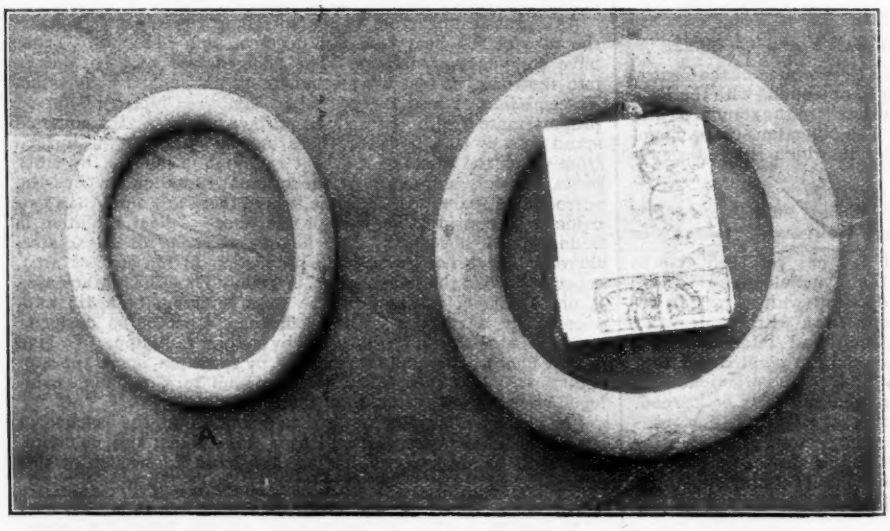


Fig. 2, a.—Rubber Ring used by Writer.

Fig. 2, b.—Rubber Ring used at Lyons.

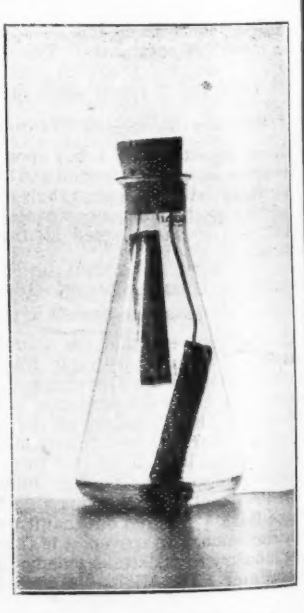


Fig. 3.—Flask with Strips under Vapour and Immersion Tests.

also obtained in various stages of vulcanization, which may be designated as:

Quarter vulcanized; half vulcanized; three-quarter vulcanized; and fully vulcanized.

Of these, the tests with the quarter and three-quarter vulcanized samples of rubber were later discontinued, being of insufficient comparative value, and tending to over-elaboration. The tests were, of course, identical for each sample, and consisted of:

(*a*) Vapour tests.
(*b*) Immersion tests.
(*c*) Impingement tests.

The reagents used in the tests were as follows:

Petroleum, used for tests and naphthalene vapourizing plant
Sp. gr. . . . . 0·81
Boiling-point . . . . 130° to 300° C.
Naphthalene solubility, 10 p.ct. by weight at 60° Fahr.

Pure Benzole:
Sp. gr. . . . . 0·885
Boiling-point . . . . 80·3° C.

Toluole:
Sp. gr. . . . . 0·870
Boiling-point . . . . 110·8° C.

Solvent naphtha:
Sp. gr. . . . . 0·875
Boiling-point . . . . 140° to 160° C.

Except in the case of tests under compression, where cubes were used, the rubber samples were cut up into standardized strips 2½ in. by ½ in. by ¼ in. These test strips were first carefully weighed, and then suspended in a flask as shown in fig. 3, which illustrates both the vapour and solvent tests in one container. The reagents used being freely volatile* were therefore in full contact with the test strips. At intervals of a few days the strips undergoing vapour tests were removed from the flask, dried for one hour, and then re-weighed. Any action of the solvent reagent upon the immersed end of the test strip was also noted. After a number of days the weighings became fairly constant; and it was then decided to complete the test.

The rubber strips were found to have increased both in size and weight. In the case of the strip which had been immersed, the rubber was found to be soft and spongy. The pure rubber in each case simply collapsed under the test and became soft and jelly-like. The semi and the fully vulcanized strips did not lose their clean-cut edges, but simply expanded as shown in fig. 4.

It will be noticed that the swelling is considerably greater in No. 3 (solvent immersion) than in No. 2 (vapour immersion). This is due to capillary action, the solvent creeping up the strip. This action was not very free, however, and distinctly diminished towards the upper end of the suspended strip. The question naturally arose as to whether this swelling was the result of physical or chemical action. The weighed strips were therefore air dried for periods of three days and one day, followed by four hours drying in a steam oven. On re-weighing after these periods, the strips were found to show a remarkable drop in weight. The immersion strips also gradually returned to normal.

These most interesting results of the vapour immersion tests have been plotted as graphs, and are shown in figs. 5 to 8.

* Note qualification in regard to petroleum under heading "Impingement Tests," p. 506.

These show the varying action of the four test solvents used, and that the petroleum had the minimum, and the toluole the maximum, effect. After the drying above described, the strips returned to their original weight within the following percentages:

Petroleum treated strip to within 3 p.ct. of the original.
Benzole " " " " 5 " " "
Toluole " " " " 5 " " "
Naphtha " " " " 8 " " "

Comparing the two rubber compositions in both grades of vulcanization, very interesting results may be noted. In the Q.M. 2 composition, in both the semi and the fully vulcanized samples, the curves are fairly comparable. Curiously enough, however, the fully vulcanized strip proved to be rather more absorbent than the

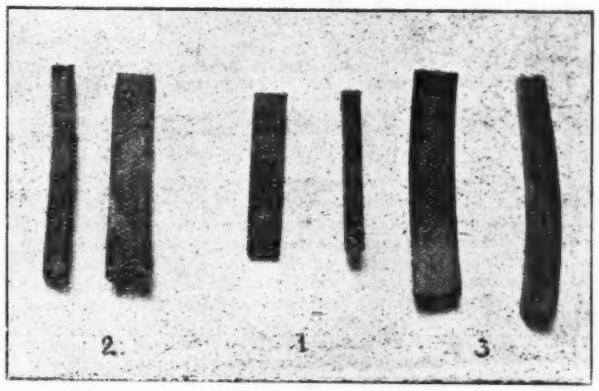


Fig. 4.—Expanded Strips.
(1) Front and side view of the standard strip.
(2) Similar strip after vapour immersion.
(3) " " " solvent "

semi-treated strip, and after drying did not return quite so closely to normal as did the former, the exact figures being:

Petroleum treated strip returned to within 3 p.ct. of original.
Toluole " " " " 5 " "
Benzole " " " " 7 " "
Naphtha " " " " 10 " "

In the Q.T. 7 composition, both in the half and in the fully vulcanized strips, the great feature of interest is the remarkable height of the benzole curve. As in the case of the Q.M. 2 composition, the fully vulcanized sample appears to have a very marked absorbent capacity for hydrocarbon solvents when placed in a suitable atmosphere. It must be noted, however, that the action is a purely physical one, as the drop curves show.

The table on p. 506 shows the exact extent of the expansion of the rubber strips caused by each of the four reagents in both the gaseous and liquid form.

It will be observed that the Q.T. 7 samples, on the whole series of measurements, show the greatest degree of expansion. The

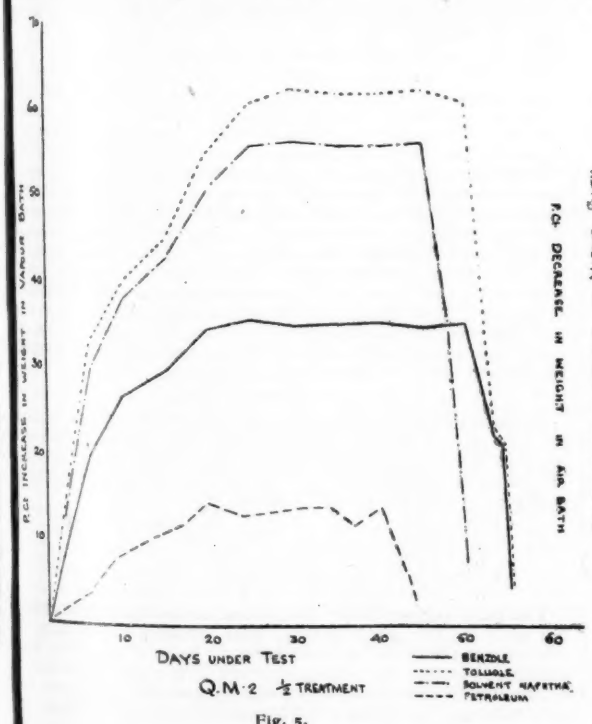


Fig. 5.

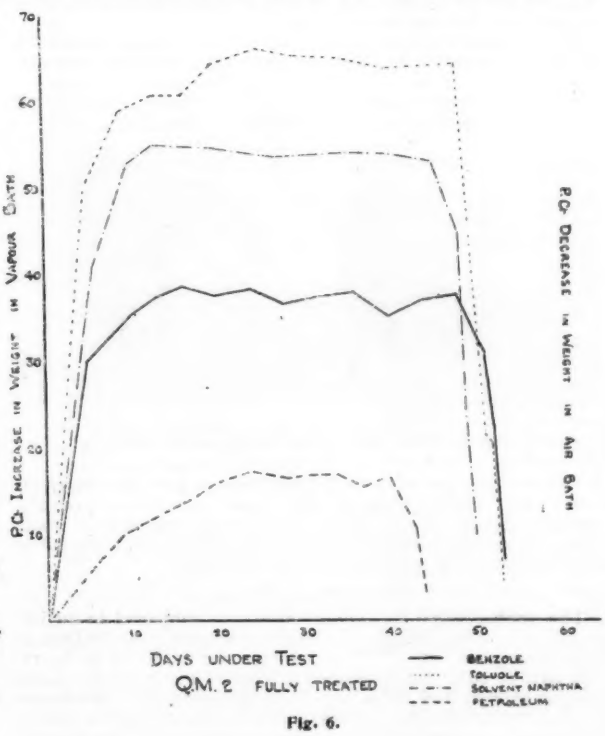


Fig. 6.

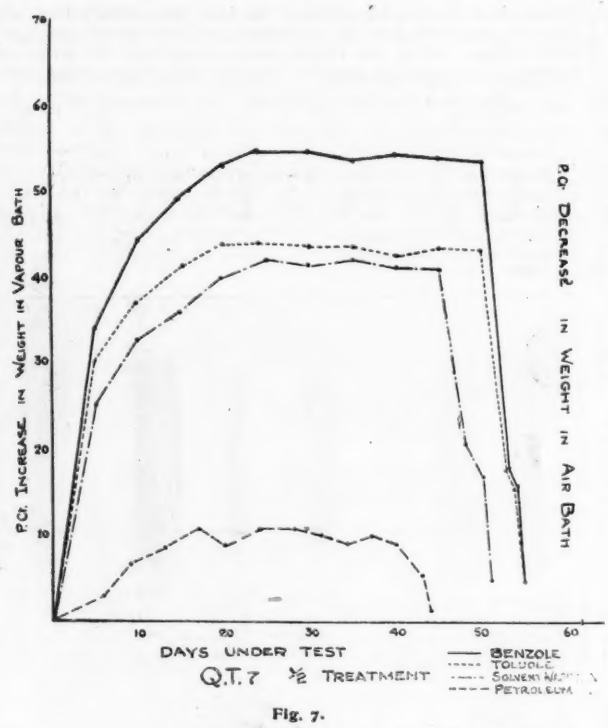


Fig. 7.

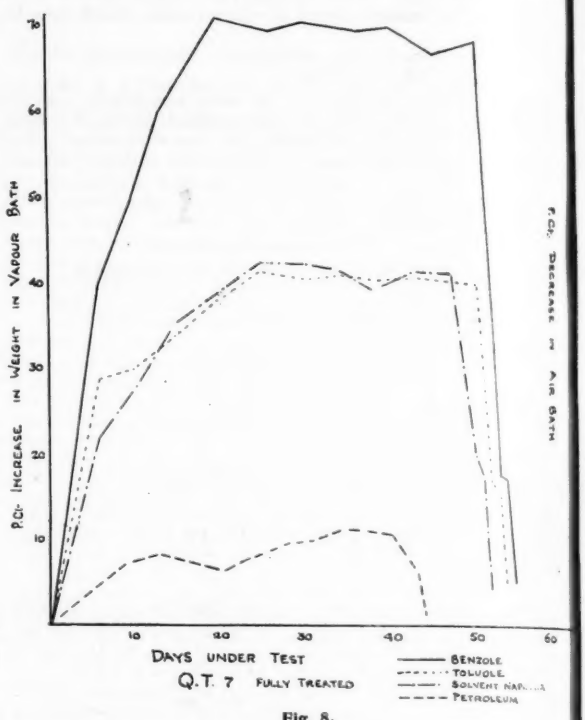


Fig. 8.

Size of Standard Strip = 2½ in. by ½ in. by ¼ in. Expansion of Standard Strip under Treatment.

	Benzole.	Toluole.	Solvent Naphtha.	Petroleum.
Vapour bath—				
Q.M. 2. Semi-vulcanized	3 in. by 11/16 in. by ¼ in.	3⅛ in. by ⅜ in. by 5/16 in.	3⅛ in. by 5/16 in. by ⅜ in.	2⅜ in. by ⅜ in. by ¼ in.
,, Fully ,,	3 in. by 13/16 in. by ¼ in.	3¼ in. by ⅜ in. by 5/16 in.	3 5/16 in. by ⅜ in. by 5/16 in.	2⅜ in. by ⅜ in. by ¼ in.
Q.T. 7. Semi-vulcanized	3⅛ in. by 7/16 in. by 3/16 in.	3 5/16 in. by 7/16 in. by 3/16 in.	3 5/16 in. by 3/16 in. by 5/16 in.	2⅜ in. by ⅜ in. by ¼ in.
,, Fully ,,	3 3/16 in. by 13/16 in. by 3/16 in.	3¼ in. by 7/16 in. by 3/16 in.	3¼ in. by ⅜ in. by 5/16 in.	2 5/16 in. by ⅜ in. by ¼ in.
Liquid bath—				
Q.M. 2. Semi-vulcanized	3¾ in. by ¾ in. by ½ in.	3¾ in. by ¾ in. by ½ in.	4 in. by 13/16 in. by 7/16 in.	The rubber strips mere
,, Fully ,,	3⅞ in. by ¾ in. by ⅝ in.	3¾ in. by 15/16 in. by ¾ in.	4 in. by 1 1/16 in. by 15/16 in.	increased in size at
Q.T. 7. Semi-vulcanized	3 7/8 in. by 1 1/16 in. by 7/16 in.	4 in. by 13/16 in. by ½ in.	4 in. by 13/16 in. by ½ in.	the actual point
,, Fully ,,	3¾ in. by 13/16 in. by 7/16 in.	4 in. by 13/16 in. by 7/16 in.	3 13/16 in. by 1 1/16 in. by 7/16 in.	of contact.

above figures, taken in conjunction with the graphs, give a fairly clear indication of what was to be expected in the compression tests. Fig. 9 shows the cubes used for compression. They were made with a hole through the centre, by passing a bolt through which the two iron end plates were drawn tightly together, thus compressing the rubber. The degree of compression was that produced by screwing-up the nut just spanner-tight. Obviously, however, the portion of the cube which slightly overhung the edges of the plate would not be at the same degree of compression as that well covered by the plate.

As a result of an immersion test of fifty days, the rubber became distended at the flat edges, as shown in the photograph;

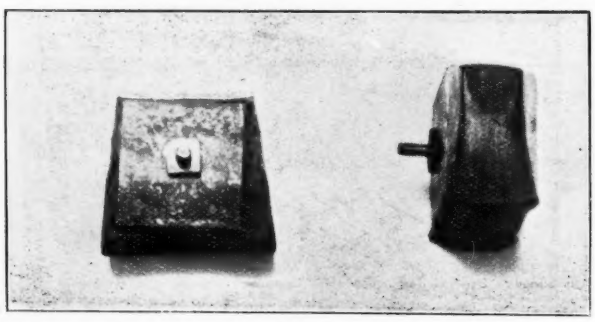


Fig. 9.—Rubber Cubes Tested under Compression.

but the action of the solvent only penetrated just past the edge of the iron plates. This is a fact of the utmost significance, from the writer's point of view, to which further reference will be made later. In this case, as in that of the free rubber strips, the cubes returned to their first condition after air drying.

Impingement Tests.

The rubber strips and cubes were then subjected to an impingement test with the same solvents as were used for the immersion and vapour tests. The apparatus used is shown in fig. 10. The strip or cube was suspended in front of a very fine jet, in the manner shown; and a fine stream of air saturated with benzole, toluole, and solvent naphtha was made to impinge on the rubber under test. No impingement tests were made with petroleum, as this oil is not sufficiently volatile at atmospheric temperatures to give a reasonable air saturation, and consequently a test, within the limit of time available. This, however, was not important, as the tests already made show that the action of petroleum upon the rubber samples was far less than that of the other reagents. As was to be expected from their higher boiling-points, and consequently lower volatility at atmospheric temperatures, the toluole and solvent naphtha tests were most difficult to carry out and yielded the lowest results. In the case of each of the semi and fully vulcanized rubbers of both grades no detrimental action could be detected after a test of over 500 hours.

In the case of the benzole impingement tests a very slight blister was detected at the point of impingement in each of the fully vulcanized rubber samples. In the case of both the semi vulcanized samples this slight blister was rather more pronounced. Air fully saturated with benzole vapour contains, roughly, five times the amount of benzole as an average sample of coal gas. The 500 c.ft. of benzolized air would therefore be equivalent, in benzole content, to 2500 c.ft. of coal gas. Taking into consideration the fact that the stream of benzolized air was an extremely fine one, acting on a small area, the experiment must be admitted to be a very critical and searching one. If the fears expressed by many as to the detrimental action of coal gas upon rubber were well founded, one would have expected that the impingement of the most detrimental of all the constituents of coal gas, in such a fine stream, in such a large total volume, for so long a time, and upon such a very small area, would have resulted in the complete perforation of the rubber sample under test.

Naphthalene Test.

Strips of the pure rubber, of the semi, and of the fully vulcanized rubbers of both grades were suspended in air saturated with naphthalene vapour at atmospheric temperature (equivalent to 11 grains of naphthalene per 100 c.ft. of air at 60° Fahr.) for eighty days, with the following results:

Pure rubber	10·7 p.ct. increase in weight.
Semi-vulcanized, Q.M. 2	8·1 ,, ,, ,, ,,
,, ,, Q.T. 7	8·4 ,, ,, ,, ,,
Fully ,, Q.M. 2	7·0 ,, ,, ,, ,,
,, ,, Q.T. 7	7·4 ,, ,, ,, ,,

The pure rubber strips were found to be surface hardened, but after a little gentle pulling, thus breaking the surface, the elasticity of the rubber did not seem to be affected. The semi vulcanized rubbers of both Q.M. 2 and Q.T. 7 qualities had deteriorated badly, and broke down with an irregular cleavage. The fully vulcanized samples of both qualities were not affected in the least, beyond the gain in weight.

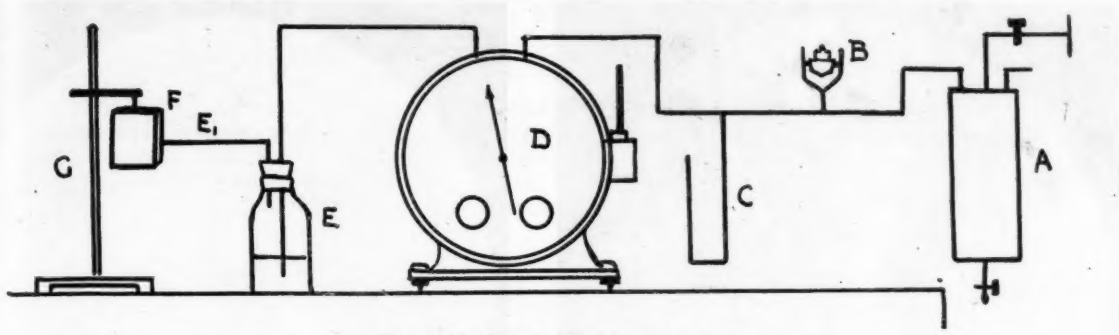


Fig. 10.—Impingement Test Apparatus.

A. Water Pump. B. Safety Valve arranged to blow at 3 in. pressure, to take up variations of water pump. C. Pressure Gauge. D. Meter. E.E1. Bubbling Bottle containing Solvent and Jet. F. Rubber Block. G. Support for Rubber.

The personal experience of the writer, supported by the results of the preceding experiments, is also abundantly confirmed by the experience of French and German engineers. Rubber-jointed pipes of the "Patent True," Gibault, and other types have been very generally used on the Continent for many years past; and the testimony of engineers who have used them is, as far as it has come to the knowledge of the writer, uniformly favourable. In view of the very strong prejudice against rubber jointing on the part of gas engineers in this country, a brief reference to a few expressions of opinion that have come to hand during the past few months may fittingly be made.

At Lyons, rubber joints have been in use since 1878, on all sizes of mains from the smallest to those of 500 mm. (20 in.) in diameter. Forty-five years is not a bad length of time for a durability test. Throughout all these years up to the present time, the results have been "always satisfactory." The mains laid down in 1878 are in satisfactory use except where they have had to be disturbed for alterations, road widenings, and such causes. Satisfaction was so complete that after nearly thirty years' experience of these joints on the low-pressure system, they were used for an installation of over eight miles of high-pressure mains laid down to supply Neuville and other outlying districts. Nine years afterwards, in 1915, rubber joints were again used on a further length of five miles of high-pressure mains laid to supply the town of Trevoux. Again in 1918, a further section of nearly two miles of rubber-jointed high-pressure mains were laid down on the Lyons-Venissieux line of supply. When forty-five years' experience of rubber joints on a low-pressure system is supplemented by fourteen years' experience on a high-pressure system, there can be no

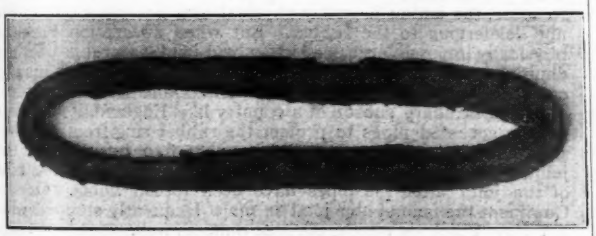


Fig. 11.—Rubber Ring from 4-in. (approx.) Main, after Use in Ground for 46 Years (1877 to 1923).

doubt in any reasonable mind as to the utility and durability of rubber as a jointing material. It would never have been used on the original high-pressure main if the previous thirty years' experience on the low-pressure system had left any doubt whatever on these points. The two subsequent extensions of rubber-jointed high-pressure mains is still more highly significant of its satisfactoriness.

These results are not by any means solitary. They are confirmed on all hands. To take only one other recent case—at Nice, rubber-jointed pipes have been in general use since 1870 on all sizes of pipes up to 20 in. in diameter, with uniformly satisfactory results. Wherever pipes have had to be taken apart for alterations, &c., and it has thus been possible to examine the rings, it has been found that, even after forty years in the ground, the rubber has fully retained its elasticity. Fig. 11 shows a photograph of a rubber ring, one of a couple which have just come into the possession of the writer, which had been in use on a 4-in. main since the year 1877. It is still perfectly elastic, as is shown by its being stretched on the board before photographing. The resilience is perfect. Except for the frayed edges, formed by the compression of the rubber between pipe and clip, in the first instance, and broken in the dissociation of the pipes, the ring is as good for all practical purposes as it was when first used forty-six years ago.

In order to obtain an absolutely unbiassed and authentic report on the condition of these rings after their long service, the writer sent one of them to the National Physical Laboratory for test. Subjoined is the official report.

Report on the Examination of an Old India-Rubber Joint Ring sent for Test by Mr. Walter Hole, of Torquay.

The ring was stated to have been removed from a gas-main joint in France, after forty-six years' use. It measured approximately 4¾ in. in diameter on the inside, and was of irregular section, since part had been compressed in the joint itself, and other portions had been squeezed out on either side. The portion expressed towards the inside of the pipe may be taken as having been exposed to coal gas for the whole time of its life. The portion expressed on the outside may have been in contact with air, water, or soil, in addition to any trace of coal gas which may have passed through the joint. The latter portion was manifestly more deteriorated than the former.

An examination of the joint ring showed that the material retained very considerable elasticity, and no effect of gas upon the cross-section could be seen by the unaided eye. It was found that the material split fairly easily in places into a number of thin layers.

A test of the resilience was first made. A piece was bound with string at both ends, and stretched as stated below for a considerable time. The load was then released, and the time taken to return to the original length observed. A difficulty was experienced in these tests by the tearing across the section at the binding. This was probably partially due to the irregular shape of the section, which caused initial cracks to appear under the binding; but, in addition, it was clear that there was a general tendency for cracking to start in the direction referred to.

(1) A portion of the ring was stretched 33⅓ p.ct. of its length, and left in this condition for nineteen hours. (After this time the material broke at the binding.) Upon release at nineteen hours, the band returned to within 1 p.ct. of its original length at once, and the stretch was entirely removed after a rest of ten minutes.

(2) A portion was stretched 66⅔ p.ct. of its length for a few minutes, and returned to its original length five minutes after the release of the load.

A thin section was taken and examined under the miscroscope at 75 diameters magnification by transmitted light. The photomicrograph is attached (see fig. 13); and it will be seen that the layers are shown, and a generally cloudy appearance. For comparison, a photograph of a similar section of a piece of new jointing rubber is attached (see fig. 14). Here a uniform texture is apparent, with the occasional presence of clearly defined opaque particles.

A small portion was partially examined chemically; and the report is as follows:

"About two inches of a rubber ring from a gas-pipe joint was submitted. For the analysis the somewhat perished exterior was removed; the part which had been in contact with the gas was cut up with the remainder of the ring.

Loss on heating at 100° C. in coal gas	2·7 p.ct.
Weight of acetone extract	7·8 ,,
Ash	20·0 ,,
Sulphur { combined, 3·5 p.ct. / free 0·6 ,, }	4·1 ,,

"The ash consisted substantially of oxide of zinc. The loss in weight of the rubber on extraction with acetone was about 2 p.ct. more than the totals of the loss on heating and weight of acetone extract. This is presumably due to the more complete removal by the extraction process of volatile matter absorbed by the rubber from coal gas during its use."

Conclusions.

From the general examination of the material and the resilience tests the ring appears to be in quite satisfactory condition, in spite of its long use. There is no doubt that many new rings would not behave better under the resilience test. The microscopic examination compared with the examination of a modern piece of rubber seems to indicate a less homogeneous structure than is obtained at the present time. This means that the original material was not so finely divided before vulcanization, and comparatively large portions of india-rubber vulcanized on the surface remain. It is possible that such an india-rubber may retain

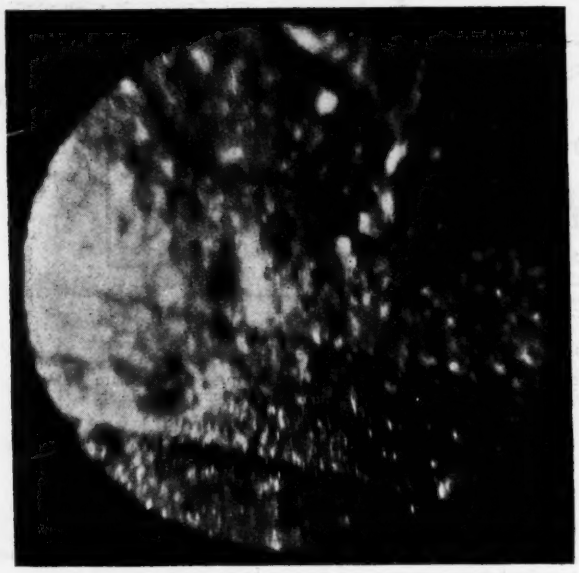


Fig. 13.—Section of Rubber from Ring submitted for Test by Mr. Walter Hole.

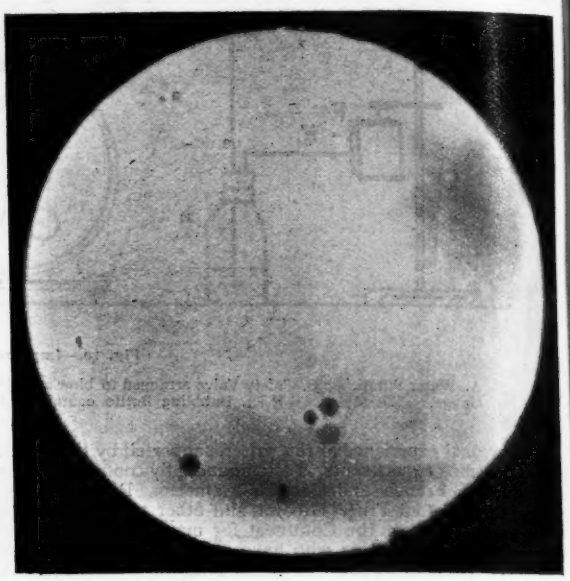


Fig. 14.—Section of Piece of New Jointing Rubber.

its resilience better than the modern intimate mixtures, unless the material is de-sulphurized after vulcanization.

The combined sulphur is large, especially considering the amount of zinc oxide originally present. The free sulphur is, however, small, showing that any hardening action due to the slow action of this free sulphur is nearly complete, though the material is still resilient.

The amount of ash is large, and the rubber was no doubt originally white in colour by the admixture of a large quantity of zinc oxide.

It is not possible to state why this ring has lasted so well, but it may be suggested that the less intimate mixture of the rubber and sulphur at the time the material was made may lead to a material which less readily hardens from the slow action of the free sulphur generally present.

Fig. 12 shows a photograph of a rubber ring taken, during alterations, from a gas-main at Nancy within the past two months, the main having been originally laid in 1910. The ring is as good for all practical purposes as it was on the day it was first used.

The writer has previously* referred to the case of some Lavril rubber rings to which his attention was drawn some years ago. These were taken from a main of 175 mm. (6 8 in.) in diameter which was laid in the year 1867. This main became too small for the requirements, and was taken up in 1906 for replacement with one of larger capacity. "The rings taken out were tested; and after having been in the ground for thirty-nine years, they were still capable of being stretched to half as much again as their normal length, without the slightest cracking . . . and parts of them were being used as pencil erasers."

If we turn from French to German experience, the reports are still the same. It is a good many years since Herr Burgomeister, in a paper read before the Association of Gas and Water Engineers of Lower Saxony, declared "that he had never discovered a rubber-jointed socket joint to become leaky in all his thirty years' experience of them."

The latest, and probably one of the most important, of German experiences has recently come into possession of the writer. The town of Recklinghausen is like some English towns in being the centre of a mining district. Subsidences of the subsoil are grave and frequent. In attempting to solve the problem which first directed the attention of the writer to the subject, Herr Zimmermann, in 1904, laid down over three miles of 300-mm. (11·8 in.) pipes with rubber joints. These have proved so satisfactory that he has since laid down considerable lengths of similar mains ranging from 80 mm. (3·1 in.) to 200 mm. (7·8 in.). In the words of Herr Zimmermann himself, "all these are holding firm, whereas leakages occur every day from the pipe-lines with lead joints." And again, "wherever mains have had to be disturbed owing to roadway alterations, the rubber rings are found in perfect condition." Again, "in my opinion the durability of these rings is unlimited."

In considering this subject, two things must be kept clearly in mind. The first is that rubber is practically incompressible. Taking the Oiffon ratio of 0·5 for water and other incompressible substances, the ratio for rubber is 0·49. On the other hand, rubber cannot take up moisture or gases without distension; but, when used for jointing gas-mains, a rubber ring is so rigidly encircled as to be incapable of expansion. This is most important, as the preceding experiments go to prove. The mere fact of its being rigidly held in this way prevents absorption of moisture or gas, as this can only take place by means of distension. It has been proved that, even if absorption and expansion are allowed to occur, the action is purely physical, and not chemical, and is not deleterious to the rubber. But when absorption becomes physically impossible, as in a rigidly held joint, assurance becomes doubly assured; and a properly vulcanized rubber ring may be considered absolutely immune from deleterious action.

In the ordinary subsoil of a country like England, it is necessary in socketed pipes to protect the rubber ring from the possible action of gritty matter which might find its way into the joint. This is usually done by putting a coil of yarn in the face of the joint after the pipes have been forced home. On the Continent the face of the joint is more frequently stopped with sott clay, which serves the purpose quite as well.

The preceding experiments go to prove, however, that a better type of rubber joint is one in which the rubber ring is completely enclosed, such as the "True" or the "Victaulic."

Summarizing the results of the practical and experimental evidence recorded above, we may fairly conclude that:

(1.) The most dangerous constituents of coal gas, in this relation, have little or no deleterious effect upon a fully vulcanized rubber of suitable composition, even where expansion is possible and when these are brought into the freest contact, in the form of either liquid, vapour, or even vapour with an impact, as in the case of the impingement tests. In many of the rubber joints now in use, the rubber is not in free contact with the stream of gas at all.

(2.) That when the rubber is rigidly held, as it always is, in a gas joint, even the slightest action does not penetrate beneath the outer skin of the rubber.

(3.) That after nearly 50 years' service in the subsoil of a large town the rubber rings retain very considerable elasticity, and show no effect of gas that can be detected by the unaided eye.

(4.) That, therefore, there is no reason, on the grounds of either utility or durability, why rubber should not be used for the jointing of gas-mains.

* "Distribution of Gas," Fourth Edition, page 89.

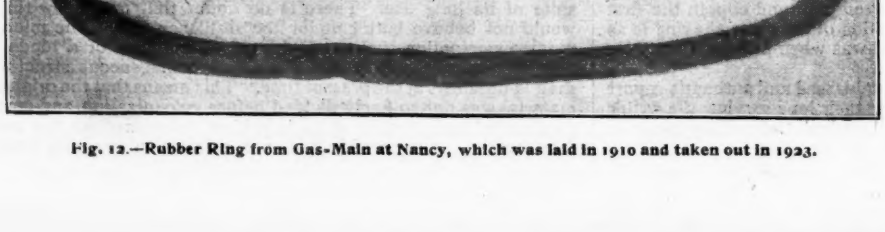
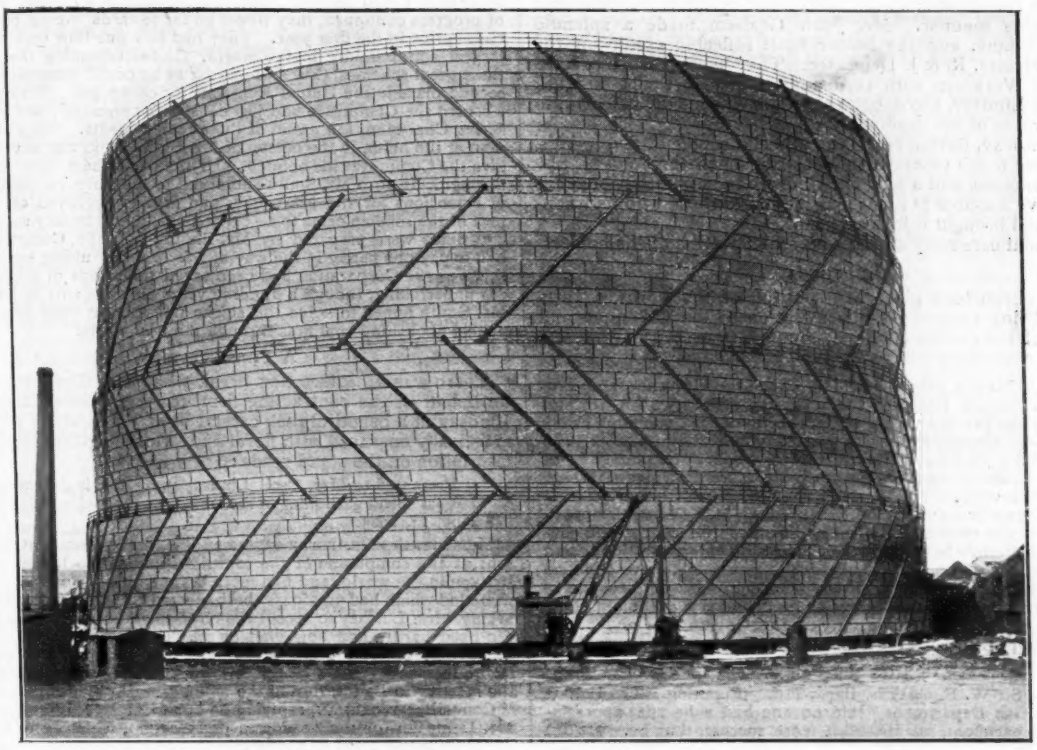


Fig. 12.—Rubber Ring from Gas-Main at Nancy, which was laid in 1910 and taken out in 1923.

NEW SEVEN-MILLION CUBIC FEET HOLDER AT BELFAST.

Inauguration Ceremony.

THE inauguration of the new 7 million c.ft. spiral-guided holder at the Belfast Corporation Gas-Works was marked by an interesting ceremony at noon last Wednesday, when, in the presence of a large and representative gathering, Mrs. Cecil Lindsay, daughter of Councillor Frank Workman, D.L. (the Chairman of the Gas Committee), turned the wheel of the outlet valve. The company afterwards adjourned for luncheon, at which interesting speeches were delivered.



THE HOLDER FULLY INFLATED.

It may be mentioned that work was commenced upon the holder in September, 1922, and it was finished on July 1 last, a record time. The holder would have been completed in June; but the work was arrested so that the interior of the holder and tank could be inspected by the members of the Institution of Gas Engineers—a privilege that was much appreciated. The tank was filled with water during July, and the holder fully inflated with air early in August.

On the day the holder was first fully extended, a very severe storm visited Belfast, causing much local damage. The holder remained perfectly steady under this severe test, and the recording gauge showed an excellent chart. The delay of the opening celebration was caused by the absence of the Chairman of the Gas Committee (Councillor Frank Workman, D.L.), but this postponement enabled the gas department to prove the soundness and working of the gasholder under all conditions.

It may be mentioned that this is the third columnless gasholder to be erected at Belfast. The first has been at work since 1895, when the water-gas plant was constructed, and has been in constant operation since. Later, an old telescopic column-guided holder was converted into a four-lift spiral to contain 3 million c.ft., and in that instance the existing tank was utilized to give double its previous service. In the new 7 million c.ft. gasholder—the largest spiral holder in the world—the Engineer (Mr. J. D. Smith, M.Inst.C.E.) introduced many improvements which his previous experience showed to be desirable; and it was designed with a wide margin of safety to provide for storms, &c.

The new storage site is separated from the old works by the River Blackstaff, and is planned to contain, in addition to the holder, two sets of purifiers, each to deal with 5 million c.ft. of gas per day, and two station meters; and at the present time contractors are busily executing this work. Already the levelling-up of the ground is almost completed, and the new boundary wall—in some places 15 ft. high—is well in hand, the Gas Committee thus finding work for the unemployed.

DESCRIPTION OF THE HOLDER.

The tank for the new holder was constructed by Mr. J. Graham, and is of brick and puddle, 252 ft. 6 in. in diameter by 37 ft. deep; and though springs were found in various places, it is satisfactory to know that the tank is perfectly tight.

Messrs. R. & J. Dempster, Ltd., of Manchester, obtained the order for the gasholder, which consists of four lifts, the outer lift being 250 ft. diameter by 36 ft. 6 in. deep, and the inlet and outlet pipes 48 in. diameter. The inner lift gives a pressure of 5½ in.; and the crown being untrussed, an additional weight of about 100 tons was secured to a stiffening girder placed round the foot of the channel-iron cups. Each lift was provided with a circular girder to ensure the lifts being maintained in true form.

The vertical stays throughout were kneed, and secured to the inside of the cups, and the footplates, forming stiffening brackets in each case, and cast-iron blocks were fixed to the underside of the dips, to distribute the weight equally round the circle. The crown was given a rise of 18 ft., having large crown sheets, 10 ft. long, radially fixed. The support for the crown is on the "Bearscot" principle of continuous circular bracket bars, carried upon brackets secured to ferro-concrete piers.

The guide carriages throughout are of the "Bearscot" four-roller all-steel type; the rollers being linked together on opposite sides. The cups and dips are 30 in. deep, giving a minimum seal of 10 in. when the holder is fully inflated; and the upper rows of plating on each lift are carried-up, to prevent the paintwork of the holder being disfigured, and also to protect the water in the dip from wind pressure. Handrailing is provided round the curb and dips throughout, a continuous ladder is fixed from the tank to the crown, and safety stops are provided at the upper ends of the spiral rails. The latest system of anti-freezing appliances has been attached, and the whole of the riveting was carried out by pneumatic power.

The Belfast Corporation have now available practically 24-hours' storage—a very happy position, considering the variable weather in that locality.

THE INAUGURAL CEREMONY.

At the inaugural ceremony, the attendance included the Ulster Ministers of Home Affairs, Labour, Agriculture, and Commerce, the Rt. Hon. the Lord Mayor (Alderman W. G. Turner, J.P.), the High Sheriff (Alderman J. A. Duff, M.P.), Councillor Frank Workman and Mrs. Workman, Councillor Hugh M'Laurin, J.P. (Deputy-Chairman of the Gas Committee), and Mrs. M'Laurin, members of the Gas Committee, other members and leading officials of the Corporation, five members of the Irish Parliament, three members of the British Parliament, members of public boards, Mr. J. D. Smith and Mrs. Smith, and representing the

contractors (Messrs. R. & J. Dempster, Ltd.) Mr. Chas. Dempster (Chairman), and Mr. J. Winson Scott.

Mr. Smith, as an interesting preliminary, presented choice bouquets to Mrs. Lindsay, Mrs. Workman, and Mrs. M'Laurin.

Councillor M'Laurin, who presided, said they were met formally to inaugurate this new spiral-guided gasholder, which was the largest of its kind in the world. The construction of the tank was commenced early in 1921, and took over twelve months to complete. The erection of the holder was commenced immediately afterwards, and pushed forward rapidly, so that the plant would be ready for this winter. It was an immense holder, and the work had been executed to their entire satisfaction. The Engineer's specifications were carried out by the contractors in a conscientious manner. Mr. John Graham made a splendid job of the tank, and the holder itself reflected credit on the builders, Messrs. R. & J. Dempster. They were pleased to have Councillor Workman with them that day. He would now ask Mrs. Cecil Lindsay, the daughter of their esteemed Chairman, to open the valve of the gasholder.

Mrs. LINDSAY, having given the wheel a couple of revolutions, said she had much pleasure in declaring open the holder. She wished it success, and a long career of usefulness. She hoped it would prove a source of great satisfaction to those who had conceived it and brought it into existence.

The formal ceremony closed with an inspection of the holder.

LUNCHEON.

The luncheon took place in a portion of the works, a large company being present on the invitation of the Chairman and members of the Gas Committee. Councillor M'Laurin presided. After the toast of the King,

The LORD MAYOR submitted "His Grace the Governor, and Prosperity to Northern Ireland," prefacing his speech with a graceful reference to the presence, after his recent illness, of Councillor Frank Workman—an allusion which was greeted with hearty applause. His Lordship paid a glowing tribute to the personality and popularity of the Governor, and in regard to the prosperity of the Province said there were signs of reviving industry.

The MINISTER OF LABOUR (the Right Hon. J. M. Andrews), responding, spoke of the record of Belfast as an industrial centre, and congratulated the public boards on their far-seeing enterprise. If it had not been for such enterprise in the past, there would have been no gas-works such as those in which they were met, nor would they have assembled to witness the inauguration of the largest gasholder of its kind in the world. It was the duty of the Government and public authorities to provide such attributes to progress and development.

APPRECIATION OF THE GAS DEPARTMENT.

Councillor Sir W. F. COATES, Bart., D.L., proposing "The Belfast Corporation Gas Department," said no one had a heartier appreciation of the department, nor wished it more success, than he. He did not propose to go into many details of the undertaking, but could not refrain from giving three or four figures to show the wonderful progress it had made. In 1874, when the undertaking was acquired by the Corporation, the consumption of gas per annum was 418 million c.ft.; to-day it was 3247 millions—almost eight times as much. The cost when the Corporation bought the undertaking was £432,000, and they had since spent on it over 1½ millions. Yet to-day the debt was something less than £550,000. During this time they had seen in control of the gas-works three—what he might call—supermen: Mr. Stelfox, who started the water-gas plant; Mr. Sharp, who unfortunately was with them only a short time; and then the Corporation were very lucky to get as his successor the present Manager, Mr. Smith. [Applause.] Mr. Smith was not a man who desired fulsome compliments, and he was not there to pay them; but he did say there was no man who more held the goodwill, not only of the Corporation, but of the Institution of Gas Engineers, of which he had just been President. They all hoped he would long remain Manager of the concern. He (the speaker) was a member of the Gas Committee for some years, and it was one of the most pleasant Committees of the Corporation with which to be associated. He congratulated the Committee and the contractors on the completion of that big job.

SOME STATISTICS.

Councillor M'LAURIN, who responded, said it was gratifying to know, in these days of very severe criticism of the actions of the members of the Corporation, there was one Committee, at all events, who had continued to do their duty faithfully and well. That day marked a very important event in the history of the works. In the year 1910 Mr. Smith went to Belfast, and took up the managership of the undertaking, and his great ability soon manifested itself; for, in the year ended March, 1914, just before the war, they manufactured 2528 million c.ft. of gas, and the profits amounted to the large sum of £66 784. During the years of the war many serious problems had to be faced, and it was mainly through Mr. Smith's great abilities that they came safely through that trying time. Last year was the most successful in the whole history of the undertaking, for they manufactured 3318 million c.ft. of gas, and the profits amounted to the magnificent sum of £127,836. In this present year they had rebuilt and modernized two benches of vertical retorts, at a cost of some £50,000, which enabled them to do just twice their original work without any additional cost. On July 1 last they took over the North of Ireland Chemical Works, at a cost of £60,000. It was very gratifying to know that, for the first four months' working, they earned a profit of £4737, as against £3769 last year, leaving a net gain of £18,968. If this rate of progress continued, they would go far towards wiping out the purchase price in the first year. They had now put into commission the largest spiral holder in the world. Notwithstanding the cost of all these great schemes, they still—so far as he could ascertain—held the second place in the United Kingdom for cheap gas. Surely this was a record the Committee had just cause to be proud of; and he, as their acting Chairman, felt proud of these achievements. They had a great man at the helm, in the person of Mr. Smith, who was never afraid to give the Committee his opinion, and then tell them how to carry it through. In 1910 Mr. Smith submitted to the Corporation his scheme of extensions for the gas-works, and it was approved of. As each part of the scheme came to be carried out, the necessary specifications and plans were prepared by Mr. Smith; and the Committee never had to pay one penny in the way of fees to a consulting engineer. In this way the Corporation had been saved thousands of pounds. The gas undertaking, though a hundred years old, was still in its infancy. Mr. Smith hoped to solve the smoke nuisance in their city by completely abolishing coal fires through the use of gas.

A PRESENTATION.

There was an interesting break when Mr. Charles Dempster, on behalf of the contracting firm, made a presentation to Mrs. Lindsay of a beautiful rock crystal bowl, the facets of which were artistically engraved with floral and ornithological designs. The inscription on the stand reads:

> Presented to Mrs. Cecil Lindsay upon the inauguration of the largest spiral gasholder in the world, at the Belfast Gas-Works.—Nov. 14, 1923.

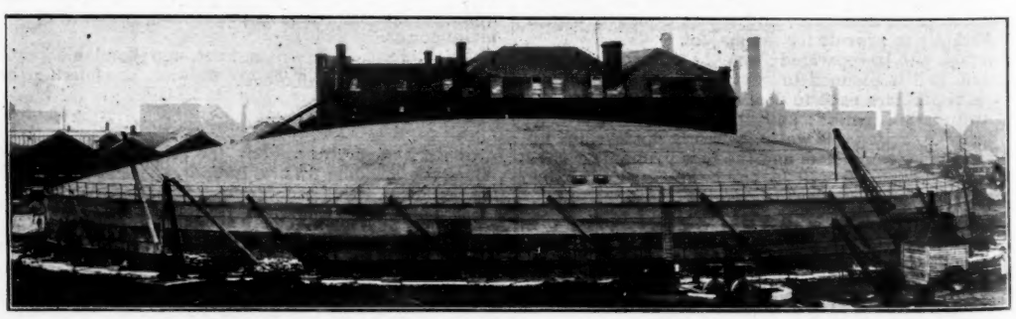
Mr. CHARLES DEMPSTER expressed his great pleasure at being present at the completion of the contract. It was the largest holder of its type in the world, and had more than double the capacity of any of that kind which had previously been erected. He had much pleasure in asking Mrs. Lindsay to accept the bowl as a memento of the occasion. He need hardly add how glad he was to see her father, Councillor Workman, present, because they had not forgotten his generosity to the Institution of Gas Engineers under Mr. Smith's presidency, at the meeting in Belfast during the summer. [Applause.]

Councillor WORKMAN, replying on behalf of Mrs. Lindsay, thanked Mr. Dempster for the handsome presentation, which he was sure his daughter would keep in happy memory of the occasion. He heartily thanked the Vice-Chairman, the Committee, and Mr. Smith for the manner in which they had carried on the affairs of the undertaking in his absence. He should also apologize for his absence from the Gas Engineers' meeting; but he was away from home. He was with them in thought, and had sent a telegram expressing his best wishes.

THE CONTRACTORS COMPLIMENTED.

The EX-HIGH SHERIFF (Councillor Hy. M'Keog, J.P.), proposing "The Contractors," said that in placing contracts reliability was the first consideration, and then price. Unless they could depend on the quality of the work done, they were likely to have an uncomfortable time during the process of erection, as, no matter how closely they watched some contractors, they could make it unpleasant if they were inclined to be selfish. Fortunately, they had no difficulties of that sort to contend with there. The Gas Committee, on the recommendation of their Engineer, accepted the tender of Messrs. R. & J. Dempster, not only on account of their reputation as one of the best firms in the world, but because theirs was the lowest tender. The firm had carried out many important contracts all over the world, and he had not heard of a single case in which they had not discharged their obligations to the letter. He congratulated them on the excellent work they had put in, not only in the erection of this holder, but in other work they had carried out for the Corporation.

Mr. J. WINSON SCOTT, responding on behalf of the firm, thanked Councillor M'Keog for his complimentary references, and said the firm had invariably the most pleasant associations with the Belfast Corporation in carrying out contracts. They had always recognized the enterprise of Belfast. They remembered in the old days of 1895 it was Belfast that fought the battle for carburetted water gas in the industry;



VIEW OF THE CROWN COMPLETED.

and, in connection with that very battle, his firm erected in that year the first spiral-guided holder for the Belfast Corporation, which had been working ever since. Belfast could not claim to be the first town in Ireland to adopt the system; that honour belonged to Portadown. But Belfast held many wonderful records as the seat of shipbuilding, linen, tobacco, ropemaking, and other industries, and that day they had made another record. He hoped this last record would not stand long [Laughter]; but in the meantime they had the largest spiral-guided holder in the world. In connection with that contract, the work had been done in record time, especially considering that it was commenced in September, and carried on largely through wintry weather. The work had been suspended by the Engineer, to allow the interior of the holder to be examined by the vistors last June. The Institution had greatly appreciated the opportunity of inspecting the holder, because there were many engineers who possibly would not have to build holders, but were pleased to have a chance of inspecting the inside of one. Their Engineer was undoubtedly a lucky man. When they completed the holder, the first day it was inflated there was a big storm which did much damage elsewhere, but caused no harm to the holder. He was quite satisfied that, with it in use, they would have no difficulty in further meeting the payments which the Gas Committee annually made for the beautiful City Hall. He appreciated all that had been done in Belfast to make the visit of the gas engineers so enjoyable, and had heard since many complimentary references to the generosity of the Lord Mayor, Councillor Workman, and others. The Deputy Chairman had said their Engineer desired to abolish coal fires—the principal cause of the very prevalent smoke nuisance. To accomplish this it was necessary to erect gasholders. It was recognized that they were not objects of beauty, and yet they symbolized more sunshine and healthier cities, for a little more sunshine was obtained for every coal fire abolished, by promoting a clearer and cleaner atmosphere. He wished Mr. Smith and his Committee every success in their propaganda. In conclusion he thanked not only the Engineer, but the whole of the gasworks staff for much assistance and many kindnesses which the contractors had received during the progress of the work. He also congratulated the Engineer, feeling sure he was proud to realize that his plans for the holder had reached such a successful termination.

ANOTHER PRESENTATION.

The HIGH SHERIFF then gave the health of Mr. Smith, whom he described as one of the foremost gas managers in the United Kingdom. He was also one of the first business men of the city. Nothing they could do in the way of appreciating his services would be adequate.

A silver statuette was then presented to the Engineer by the Deputy Chairman of the Gas Committee, on behalf of the contractors, so that he might have a record of having designed the largest spiral gasholder.

Mr. SMITH received an ovation on rising, cheers being given for him and Mrs. Smith. He said that the reception given to the toast of his health was extremely gratifying. It must be admitted that the work now carried to completion had been a severe tax upon his time, and necessitated much care and thought; but it had now been successfully completed. He was satisfied that the plant would be a great benefit on the trying winter days, when one had to strain every nerve to give the city a plentiful supply of gas. The construction of the tank was commenced by the contractor, Mr. John Graham—whom he was glad to see present—in March, 1921; and though many difficulties were encountered, it was completed in July, 1922. It was interesting to recall that the work necessitated the excavation of about 43,000 tons of clay, while the tank contained 1,125,000 bricks. There were also used about 4000 tons of cement, and 11,000 tons of puddle clay. The men employed numbered 170, and the work was carried out under Relief Schemes 358 and 47, the first under the Imperial Parliament, and the second under the Northern Government. Messrs. R. & J. Dempster, contractors for the holder, commenced work in July, 1922; and that day they were celebrating the completion of the contract. The contractors during that time had given continuous employment to about 70 men, many of them skilled tradesmen. The holder was also under the Unemployment Relief Scheme. The steelwork was all prepared in Messrs. Dempster's workshops in Manchester, where they had all the special tools necessary for the work, and the plates, &c., were then sent forward marked and ready for erection. Many novel devices were employed for the first time, principally in riveting. The gasholder now finished formed part of his scheme of extensions submitted to the Corporation in 1910. The most urgent necessity had been the provision of up-to-date carbonizing plant; and by the time this was provided the war had broken out, and stopped all new work. He had found it necessary before this to scrap two small holders, and to construct a new gasholder in one of the existing tanks. This gave a storage capacity of 6¼ millions, which was about one-half of their maximum day's output, and was therefore totally inadequate. By providing these new holders they would have a total storage of 13¼ millions, which was about the amount of gas sent out every 24 hours in the month of December. In conclusion, he said that any success he had achieved had only been rendered possible by the help and sympathy he had received at all times from the Gas Committee. He had only had to convince them of the necessity of any proposal submitted; and their encouragement had been a great incentive in all his efforts. As to the presentation, he was deeply indebted to the contractors for the reminder of the gasholder. It was scarcely necessary to remind him of the holder, for it was the first thing he saw when he opened his eyes in the mornings, and the last before he went to sleep. Probably some nights he would be seeing it in his dreams! However, he was very glad and proud to have that memento of the enterprise; and he wished most heartily to thank them.

The proceedings closed with the singing of the National Anthem.

Gas Generators and Industrial Furnaces, Ltd., has been registered, with a capital of £5000, in £1 shares.

A CENTRIFUGAL PROCESS OF PIPE MANUFACTURE.

During the Shipping Exhibition at Olympia, Mr. E. J. FOX (the Managing Director) and Mr. P. H. WILSON (Foundry General Manager) of the Stanton Ironworks Company, Ltd., submitted a paper in which they described pipe manufacture by the centrifugal process. The process in question is due to M. D. Sensaud de Lavaud, who first began to work it commercially in 1914, after seven years' research work, on which it is said a sum of £70,000 was spent. There are at present only four of these plants in the world operating M. de Lavaud's patents (under licence from the International de Lavaud Corporation, Ltd.). The plant now being worked by the Stanton Ironworks Company is said to be the largest in existence for the production of spun iron pipes.

The process consists of feeding the various materials necessary for the production of the molten metal into special cupolas in pre-determined quantities; the human element being eliminated to a large degree. There are two of these cupolas at Stanton, each having a melting capacity of 10 to 12 tons of metal per hour. The arrangements are such that the melting conditions are regulated with a degree of exactitude impossible with the ordinary casting process. The molten metal is tapped into 3-ton casting ladles, which are conveyed to the casting bays of the moulding shop by means of a 5-ton electric crane. The molten metal, when it leaves the cupola, is of the usual foundry-iron structure, and has an average tensile strength of 9½ to 11 tons per sq. in.; but, as was seen in micro photographs, after the spinning process the structure undergoes several almost startling changes. The structure was noticed to be entirely free from blowholes and of much closer grain. In order to place this fact beyond all doubt, a series of some 10,000 tests have been carried out by independent laboratories over a period of seven months; and the results have shown an average tensile strength of the spun metal of from 17 to 20 tons per sq. in., against 9½ to 11 tons for ordinary foundry iron—both metals, of course, being of the same original analysis. Again, the modulus of spun iron is high, and the metal is very ductile.

Coming to the actual spinning process, the molten metal is run into a steel mould; the latter being revolved by an impulse water turbine, inside a water-cooled iron casing. A tilting ladle and a cantilever trough supply the metal to the revolving mould. The only core used is that which is necessary to shape the inside of the socket of the pipe. The tilting ladle holds slightly more metal than is necessary for a single pipe of the size to be cast. The molten metal in contact with the water-cooled mould solidifies in a few seconds, and, contracting slightly, allows the pipe to be withdrawn, after which it is conveyed to a gas-fired annealing furnace, at red heat, thus conserving the residual heat. The temperature of the pipes when entering the annealing furnace is about 1250° Fahr.; and this is steadily increased to 1800°. They are then allowed to cool slowly in the lower part of the furnace, and emerge at a black heat convenient for coating. The gas-fired annealing furnaces use a gas of a calorific value of 225 B.Th.U. Thompson waste-heat boilers are installed for steam generation; and use is made of the heat remaining in the pipes as they are cooling in the lower portion of the annealing furnace. Upon withdrawal from the annealing furnace the pipes are cleaned and then passed immediately through the dipping tank in a horizontal position. The coating mixture is Dr. Angus Smith's standard solution. When dried, the pipes are taken to the hydraulic plant, and tested at a pressure at least 50 p.ct. greater than that specified in the British Standard Specification for cast-iron pipes.

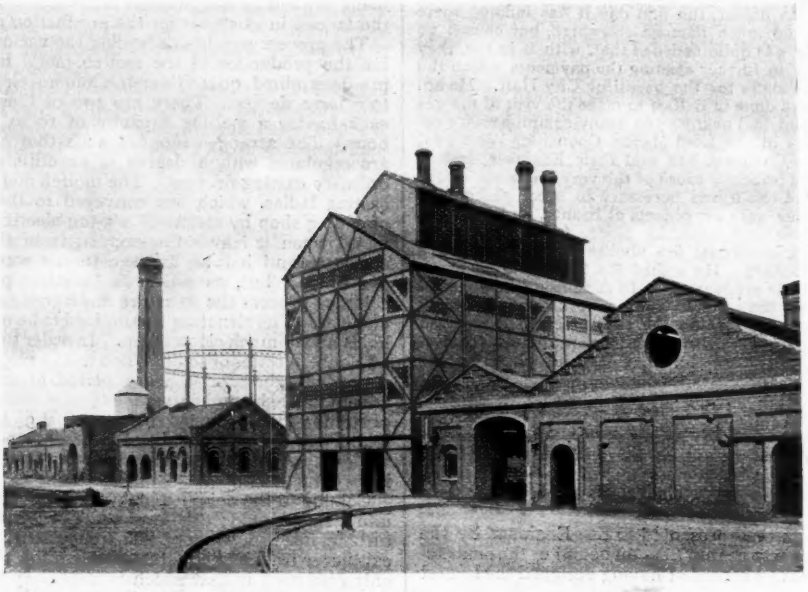
On account of the high tensile strength of the spun metal, it has been found possible to design a thinner and consequently lighter pipe than the ordinary sand-cast pipe. It is approximately 25 p.ct. lighter; and as the tensile strength is at least 70 p.ct. higher than that of cast iron, the resultant pipe is, notwithstanding its being lighter and thinner, still 30 to 40 p.ct. stronger. The pipes have been found to machine well and cut easily. When tapped for an ordinary gas connection, the tap leaves a full regular thread, free from chipped edges. External load tests, also carried out by independent people, have been conducted to ascertain the ability of the spun iron pipe to withstand heavy road traffic. With a live load, spun pipes will break on an average with the following weights: 12 in., 4·98 tons per foot length; 10 in., 5·41 tons; 8 in., 6·02 tons; 6 in., 7·30 tons; and 4 in., 9 19 tons. In a trench, these pipes would, it was stated, carry a load 1·9 times greater. Thus, in the case of the 12-in pipe, a load is sustained of 9·46 tons per foot run—a figure far in excess of any load that may be applied through vehicular traffic.

Natural Gas and Town Gas in Pennsylvania.—More than 500 towns in the State of Pennsylvania use natural gas, while there are over 200 manufactured-gas using towns. The latter represent 710,000 consumers, while the natural gas consumers number 481,000. Natural gas has been developed in twenty-three, and is used in twenty six of the counties of the State. A large quantity is also imported from West Virginia, and a small quantity is exported to West Virginia and New York towns. Manufactured-gas using towns are in the eastern part, and the natural-gas using towns in the western part of Pennsylvania.

VERTICAL RETORT-HOUSE EXTENSION AT TIPTON.

Further Glover-West Carbonizing Plant.

THERE was a notable assembly at the gas-works of the Tipton Urban District Council last Wednesday morning, on the invitation of the Chairman and members of the Gas Committee, for the official inauguration of the Glover-West continuous vertical retort extensions and an inspection of the works. Under the guidance of the Chairman of the Committee (Councillor T. E. Salter, C.C.), the Engineer and Manager (Mr. William Prince), Alderman Fred. J. West, and Mr. Frank West, a careful examination was made of the works, about which, then and subsequently, many kind things were said. The undertaking generally, and the new work, were well described in an illustrated brochure, from which the following account has been taken.



GENERAL VIEW OF WORKS, SHOWING THE EXTENDED VERTICAL RETORT-HOUSE.

HISTORY OF THE GAS SUPPLY.

Gas was first supplied in Tipton about the year 1845 by the Birmingham and Staffordshire Gas Light Company, from their works at Swan Village. This undertaking was acquired by the Birmingham Corporation in 1875, and in 1876 the Tipton Local Board of Health sought and obtained powers to purchase the rights of supply so far as the Parish of Tipton was concerned; the purchase price being £34 744. This figure did not include works, which had to be built at a cost of £40,000. They are conveniently situated almost in the middle of the parish, and contain railway sidings from the L.M. & S. Railway, and a canal basin. They were designed by the late Mr. T. Proud, and were opened on July 1, 1882. In 1890 the storage capacity was found to be insufficient, and a new holder of 370,000 c.ft. capacity was erected, bringing the full storage up to 660,000 c.ft. The progress of the undertaking is indicated in the following statement:

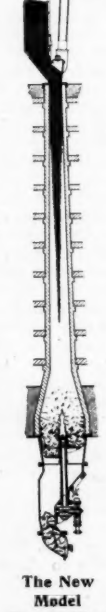
Year.	Gas Manufactured.
1882	75,000,000 c.ft.
1892	96,778,000 ,,
1902	100,450,000 ,,
1912	138,665,000 ,,
1922	171,987,000 ,,
1923	183,773,000 ,,

New purifiers were erected in 1902, and a Dellwik blue water-gas plant installed. Further extensions were necessary in 1914; and £12,000 was expended on the provision of a new retort-house, with Glover-West vertical retorts of a capacity of half-a-million c.ft. per day, new engine and boiler house with two Lancashire boilers, 20 ft. by 7 ft., to work at 120 lbs. pressure, and a new rotary scrubber. The manufacturing capacity of the undertaking was thereby increased to 800,000 c.ft. per day. Another addition to the works was the erection in 1921 of a tar dehydrating plant. The steady increase in the consumption of the gas necessitated further additions to the carbonizing plant this year; and it was decided to enlarge the existing installation of vertical retorts, increasing the maximum make to 1,800,000 c.ft. per day.

THE GLOVER-WEST RETORTS.

The extension of the Glover-West vertical retort installation, originally put into operation in February, 1914, takes the form of sixteen further retorts arranged in two settings, and heated in units of four. Coal is brought to the installation by way of the elevator built with the original plant, to which a push-plate conveyor has been added.

The general principle of the Glover-West system of continuous carbonization remains the same as in the original installation. Coal broken to a suitable size and elevated to overhead storage bunkers passes through a Glover-West patent rotary coal valve to a coal-feed hopper which is in direct communication with the retort, and from which it passes automatically to the retort at a rate governed by the speed at which the coke is continuously withdrawn by the patent helical, or worm, coke extractor. The retort is elliptical in shape, as in the original installation, but the base is opened out to a circular section on the new model. The effect of this development is that the core of coke presents a greatly increased surface to the action of the steam admitted to the coke chamber. Resulting from this and from the improvements made in the system of heating the retorts, the carbonizing capacity is increased by 50 p.ct., and the yield of gas by nearly 100 p.ct. per retort.



The New Model Glover-West Vertical Retort.

The setting retains the well-known characteristic of a series of horizontal heating chambers, each of which is separately adjustable, so that the distribution of heat throughout the length of the retort can be varied to suit any class of coal; but the new principles of the internal waste-gas uptake, the secondary-air uptake in the back wall of the setting acting at once as a regenerator and as a means of insulation, and the provision of a secondary point of combustion, have been incorporated in the design of the new installation. The residual heat of the coke is utilized to raise the temperature of the steam to that necessary for the water-gas reaction, so that this is effected without interfering with the simultaneous process of dry distillation in one and the same retort. The heat of the waste gases is transferred to the incoming coal at the top of the retorts. The steam is generated in a waste-heat boiler of the West-Galloway type arranged on a by-pass at the base of each chimney. It leaves the boilers at a temperature of about 500° Fahr. and 100 lbs. per sq.in. pressure, which is reduced to between 10 and 20 lbs. at the coke chambers. By this means economy of fuel is secured, since the heat recovered from the waste gases is taken back to the retorts by the superheated steam.

The gas leaves the retorts by way of ascension pipes, each of which is controlled by a West patent gas-valve, and enters the gas-collecting mains supported above the retort, in which the primary condensates separate out. Each retort is a separate and distinct unit as regards control, admission of coal, exit of gas, and extraction of coke.

The Glover-West coke extractor takes the form of a helical inclined plane rotating on a vertical axis. The extractors are driven by an extension of the original system of reciprocating gear, actuating oscillating levers which drive the extractor itself by a ratchet motion. Between the ratchet pawl and the wheel is a "mask," the position of which determines the number of teeth engaged by the pawl in each oscillation, and the speed of carbonization in the retort. The coke is discharged through a door, automatically sealed without water, into the coke wagons.

LABOUR CONDITIONS.

The improved labour conditions under which retort-house duties are carried out in this system, as compared with the older system of horizontal retort, are very striking. Not only does the new installation give a still further increased make of gas per ton of coal handled (nearly double the yield of gas on a given area), and the uniform quality and composition of gas and economy in fuel to which Tipton has been accustomed since the introduction of the Glover-West system in 1914, but the absence of smoke and steam and arduous labour in the retort-house generally is thoroughly appreciated by the workmen. To these advantages the new installation will add a reduction in operating costs.

CONDENSERS.

In order to accommodate the extension of the vertical-retort plant, and to replace obsolete apparatus, it was considered advisable to provide a new set of water-tube condensers, which were supplied by Messrs. R. & J. Dempster.

The gas from the condensers passes through the exhausters and washing and scrubbing plant to the purifiers, which are of the stage-floor type with revivifying floor beneath.

SUMMARY OF RESULTS OF THE TESTS CARRIED OUT IN THE NEW GLOVER-WEST RETORTS AT TIPTON ON DURHAM-LAMBTON COAL, SEPT. 4 TO 8, 1923.

Measurement.—The coal was accurately weighed into the plant; and the coke weighed out.

The gas was measured by the works meter, which had been tested and corrected a week before the test was carried out.

The calorific value was observed on a recording calorimeter checked by a Boys standard calorimeter.

Coal.—The coal carbonized was Lambton (Durham), of which the approximate analysis was:

	P.Ct.	
Moisture	1·13	
Volatile combustibles	32·44	dry basis.
Ash	5·73	
Fixed carbon	61·83	

Note.—The sample of coal showed it to have the characteristics of a typical Durham coal, the coke button produced being large.

Retorts.—Glover-West 1922 design, measuring 33 in. by 10 in. at the top, and 25 ft. long, with the patent "steaming chamber" at the base of the retort.

Gas Yield.

Throughput per retort per 24 hours	3·65 tons
Gas per ton (corrected)	15,825 c.ft.
Gross calorific value per c.ft.	507 B.Th.U.
Therms per ton	80·3
Output per 8 retorts per 24 hours (corrected)	462,100 c.ft.

Fuel to Producers.

Coke consumed per 100 lbs. of coal carbonized	13·7 lbs.

Fires cleaned (clinker removed) every 8 hours.
Fires pricked up (no cleaning) every 8 hours.
Fires charged (half-hour after cleaning and clinkering).

Coke to Yard.

After deducting producer supply: Per ton carbonized, 11·34 cwt., made up as follows:

Over 1 in.	= 10·61 cwt.
1 in. to ½ in.	= 0·14 ,,
Below ½ in.	= 0·59 ,,
Total coke and breeze for sale, per ton of coal carbonized	11·34 cwt.

Analysis of Coal Gas.

	P.Ct.
CO_2	4·5
O_2	0·3
C_nH_m	3·1
CO	11·5
CH_4	22·83
H_2	52·58
N_2	5·19

Calculated calorific value, 506·5 B.Th.U. per c.ft.

Waste Gas.

Average of various samples taken at first circulating chamber—

	P.Ct.
CO_2	18·1
O_2	1·6
CO	0

Liquor, 25·5 galls. of 10 oz. strength.
Tar, 11·7 galls. (dry).

(Signed) WILLIAM PRINCE,
Engineer and Manager.

LUNCHEON.

After the inspection, a party of about seventy sat down to luncheon at the Royal Oak Hotel, Dudley Port, Tipton, under the Chairmanship of Councillor T. E. SALTER (the Chairman of the Gas Committee), and some time was spent in toasting and song. After the Loyal Toast had been sympathetically submitted by the Chairman, and enthusiastically honoured,

THE GAS UNDERTAKING A GREAT BOON.

Councillor S. WEBB, J.P., proposed "Success to the Tipton Gas Undertaking." He said he presumed he had been asked to do this because it was well known that he stood for the municipalization of all the prominent public services, such as gas, electricity, trams, and water. It was to the credit of the older members of the Tipton Local Authority that they possessed sufficient foresight and wisdom in those days to secure powers whereby they were enabled to serve the community with three of these important things—gas, electricity, and trams. In the matter of the last two, however, they had not themselves put these powers into operation, but had leased them to others. The gas undertaking had unquestionably been a great boon, to consumers and ratepayers alike; and it was further proof of the foresight and wisdom of the Council that they had so readily and unanimously agreed to an additional expenditure of some £25,000 or £26,000 on the extension of the works. They certainly anticipated success; and with an Engineer of no mean ability, with a Chairman who was the embodiment of enthusiasm, with a Committee who were in downright earnest, and with a modern plant such as they had inspected that day, this success appeared to him to be practically assured. The greater the success of the gas undertaking, the greater would be the benefit to the whole community of Tipton. He therefore asked them all to join with him in drinking to the toast, with which he coupled the names of the Chairman and of the Engineer.

THE IMPROVED LABOUR CONDITIONS.

The CHAIRMAN, responding, remarked that the main consideration which had led him to champion the cause of vertical retorts had not been the financial one, though he had felt quite satisfied that the result would be a substantial reduction in the carbonizing charges. What had chiefly influenced him was the vast improvement that would be brought about in labour conditions, as compared with those prevailing in their old horizontal retort house. Had they attempted to equip the horizontal retorts with machinery, it would probably have cost more than the vertical retorts, and they would not have got anything like the same results. An important point was that the Committee did not hesitate so much in spending £19,000 on the second installation of verticals as they did over spending £12,000 on the first installation, because they had meanwhile amply tested the plant, and so had made themselves fully acquainted with the justification for its adoption. It did not every day fall to the lot of a gas manager to witness the laying-down, the progress, and the completion of such a beautiful plant as they now had at Tipton. They all had the greatest confidence in Mr. Prince before, but now that he had this experience of the Glover-West system, he must be a far better manager than he was when the plant was commenced. The only figures to which he would draw their attention were those regarding the tests on Durham coal—at the end of the brochure, copies of which had been distributed. What had in this case been accomplished with Durham coal should provide gas managers with food for thought. With this plant, they were on the high road to great success; and he anticipated that they would be able to make gas as cheap as any in the Midlands. The Committee believed that the consumers of gas should be the beneficiaries of this cheapness when it eventuated, and they would therefore pass on to them any reduction in cost that this extension of the vertical retort installation might bring about. He strongly held the view that the Tipton Gas Committee should regard themselves in the light of benefactors to the town. He looked for industrial expansion, and hoped the gas-works would play their part in this direction. It had been necessary to claim the indulgence of the consumers while a large bank overdraft was being cleared off. During the war, when they were not permitted to charge more than 4s. per 1000 c.ft., their neighbours were charging 5s. and 5s. 6d.

A CONTRACT MOST SUCCESSFULLY CARRIED OUT.

Mr. WILLIAM PRINCE said the makes of gas for different years shown in the brochure marked wonderful growth; but they were hoping for still greater things in the future. Before proceeding any further, he desired publicly to acknowledge the whole-hearted support he had received from the various Chairmen of Committee under whom he had worked, and from his staff and workmen, who had loyally co operated with him. It had afforded him much gratification to witness the opening of the new vertical installation, because it meant that their consumers were to enjoy in the future a much-improved service from the gas-works, and one which had been for some considerable time almost impossible during periods of fog and bad weather. To-day, another 1 million c.ft. of gas per 24 hours had been made possible, and this would obviate any necessity for curtailment of supply or pressure in any direction or from any cause whatever. He was also mindful that this important extension had been completed well within the contract time, and, further, without any accident of any kind to mar the accomplishment. It had been a continuous source of pleasure that the work was so perfectly done in the shops of the contractors that scarcely a bolt, nut, or hole required adjustment. Of course, the contractors had met with difficulties in connection with the foundations, and in linking up with an existing building, but those of them who had noticed the addition might well have imagined that, like the lilies, they had grown side by side. Another pleasing feature in the carrying-out of the contract had been the immunity from lost time. The foundations were commenced on Oct. 11, 1922, and completed on Dec. 11 ollowing; while the erection of the new plant was completed on August 2 last. The test of Durham unscreened gas coal, as set out in the brochure, would, he thought, satisfy the most fastidious as to the capabilities of the new plant. When Tipton, ten years ago, decided to provide a vertical installation, they were practically pioneers in this country; and to-day they had adopted again the very latest type of this form of carbonization. He was mindful of the fact that the Tipton undertaking had acted in a similar capacity in connection with the introduction of blue water-gas production, and also in the adoption of luteless lids for purifier boxes, and the equally important system of automatically lighting and extinguishing the public lamps by the Alder and Mackay pressure-wave plan—a system still in vogue, and applied with every success to all public lamps in the extensive parish. Consequent upon the erection of the new verticals, they had provided new water-tube condensers of 1 million c.ft. capacity, prepared for extensions; while a 2 tons per day sulphate of ammonia plant was nearing completion. Two years ago, they installed a 12 tons per day tar dehydrating plant to meet the requirements of their own Authority, in making up new roads to the Road Board Standard Specification.

They had further installed a 24-in. governor and connecting main for some considerable distance from the works; while so much work had been carried out in the works, a vast amount of both time and money had been spent in improving the distributing system. In all cases due regard had been paid to the increase of consumption in a growing district. Over 200 new cookers had been fixed during the past three months, together with numerous fires, radiators, &c. New fitting shops, with meter repairing and testing station, had also been incorporated on the works; and he ventured to state that the Tipton Gas-Works, with its private railway sidings and canal basin, &c., was one of the most up-to-date works for their size in England.

AN IMAGINARY DIALOGUE.

Councillor A. PARKER (the Vice-Chairman of the Gas Committee) submitted "The Contractors—Messrs. West's Gas Improvement Company." He said it seemed to him that, if it were able to speak at all, what would speak best about the contractors would be the plant itself. So when he was down at the works that morning, he asked the plant, "What sort of a firm is West's Gas Improvement Company?" The reply of the plant was that the firm were of the same pattern as the plant itself—namely, of the upright pattern. They could be safely relied upon. Another similarity pointed out by the retorts was: "We have cool heads; so have the Directors, who are cool-headed business people. At the same time, just as we are warm-hearted, so are they. But," the retorts went on to say, "there is one thing we strongly object to. The firm would not like for one moment to be accused of having cold feet; but they provide us with them, and we are kicking coke out with these cold feet." Another thing the retorts said was: "It is very commendable for West's Gas Improvement Company to try to make two blades of grass grow where one grew before. They have installed, upon the same area as was utilized by the old plant, a plant which will produce twice as much gas, so that they have, in fact, succeeded in making two blades of grass grow where one grew before." Further they said: "The firm are very economical; they waste nothing." As regarded the working of the new plant, the Tipton people would reap the benefit of this. That they could produce so much gas per ton of coal spoke very well for the design of the plant. The firm possessed very efficient heads, and staff and workmen, who all combined to produce the very efficient plant they had seen that morning, and they were to be congratulated upon their organization. They had achieved success, and, what was more, they had deserved it.

A PRESENTATION.

Alderman FRED. J. WEST, responding, remarked that Councillor Parker had drawn forth from the plant a number of compliments which he certainly hoped the firm deserved. It was a peculiar pleasure to be present at this inauguration to-day, because it reminded one of a similar function ten or eleven years ago, when the first installation of vertical retorts was completed. It was always a great pleasure to a contractor to have, after a period of years, to carry out a second contract for the same undertaking. As a matter of fact, one of the most pleasing features of the business with which he was connected was the many occasions on which they resumed relationships with a gas-works after a term of years. He could point to many places where they had put down, not only a second, but a third, and even a fourth, installation. The Tipton Council could congratulate themselves on having an up-to-date gas-works in every respect—a gas-works which were a tribute to the skill of their Engineer, and a very valuable asset to the community. The Chairman, in his remarks, had made reference to the old system of hand-charging retorts. He remembered many years ago seeing a lurid picture of the way in which gas was manufactured, and the letterpress description likened it to hell on earth. Well, they did claim, with a considerable amount of confidence, that they had to-day made a gas-works a place fit to live in. Apart from the better carbonizing results, they had vastly improved the conditions of the workers. His firm were very grateful to the Tipton Council for the opportunity they had given them of making a test with Durham coal for an important gas undertaking This test, he was glad to say, had been successful in securing a contract for a Glover-West vertical installation. He would like to take this opportunity of asking the Chairman of the Council and the Chairman of the Gas Committee each to accept from the contractors a small memento of the proceedings in the form of a silver cigar case. These cases (suitably inscribed, and having engraved upon them the design of a continuous vertical retort) would carry with them the best wishes of the firm. Might the recipients long be spared to take part in the public work of Tipton!

Councillor W. WOOLLEY DOUGHTY, J.P., C.C. (the Chairman of the Council), said he would ever look upon the gift as being not a personal one, but one made to the Chairman of the Council of the township of Tipton. The greatest possible compliment had been paid to the firm by the Council in asking them to put in a second installation of their vertical retorts. He believed that at the present moment Tipton had one of the finest gas-works in the United Kingdom. Had it not been for the vertical retorts during the war, they could never have carried out their obligations. Now they were happy in the knowledge that in the immediate future greater profits would be made and a better quality of gas supplied.

Mr. SALTER also, in appropriate terms, acknowledged the gift.

Mr. DOUGHTY next proposed "The Town and Trade of Tipton." The town of Tipton was, he said, easy for him to extol, having lived in it now for nearly sixty years, 35 or 36 of which had been spent in the public service. They owned their gas undertaking the moment the opportunity of doing so presented itself. It was true that the coal industry had gone from the town; but the surface of Tipton was now far more valuable from the point of view of providing work for the people than the coal underneath it.

The toast was responded to by Mr. HAROLD HALES, Mechanical Engineer, Birmingham Canal Navigations. Councillor W. J. W. GEORGE (the Chairman of the Education Committee) submitted "Our Visitors;" and this was replied to by Mr. J. W. ALLIN, Gas Engineer at West Bromwich, and Mr. A. MATTY, of Tipton.

Mr. Henry Smethurst, J.P., who was a Director of the Grimsby Gas Company, left estate of the gross value of £23,465.

MIDLAND JUNIOR GAS ASSOCIATION.

Visit to the Works of Messrs. Evered & Co., Ltd.

A large party of members of the Association visited Smethwick last Saturday, to inspect the works of Messrs. Evered & Co., Ltd. On arrival the party were received by Mr. Howard Wilson (Managing-Director) and his co-Directors, Mr. S. Evered and Mr. E. Wilson.

After photographs had been taken, the visitors split into small groups, and were conducted round the extensive works, which cover some 4 or 5 acres, and employ about 600 people. In most of the shops sufficient employees were working to demonstrate the different processes, and this added largely to the interest. The parts visited included the foundry (plate moulding and sand blasting), capstan shop (machining of small brass parts), press shop and burner shop (pressing burner crowns and assembling, spot welding of steel), plating shop, plugging and turning shops, testing shop, making shop (lighting fittings), assembling shop, lacquering room, tool room, experimental room, and tube mill (solid drawn tubes).

Following the inspection, the visitors were entertained at tea.

Mr. HOWARD WILSON, in a short speech, extended a cordial welcome on behalf of the Company. He remarked on the interest taken in all the operations, and emphasized the value of co-operation between those actually engaged in the gas industry and the makers of the various fittings and appliances, if the general public were to receive the best possible service. They, as manufacturers, were always glad to receive suggestions from gas people to this end, and were desirous of doing everything they could to help the industry.

Mr. L. H. THOMAS (the President) proposed a hearty vote of thanks to the firm for their kindness and hospitality, and particularly to those gentlemen who had conducted the parties round the works, with so much willingness to explain everything. Many of them had not until that day realized the large number of processes through which even the most common type of gas-apparatus had to pass in the course of manufacture, and they had been astonished at the care taken in every detail to ensure the best possible results. He appreciated Mr. Wilson's remarks on co-operation. It was no use for gas suppliers to make the best gas, if the fittings were so poor as soon to give reason for complaints. If all fittings were made up to the high standard of Messrs. Evered's production, there was no reason to doubt that the public would be satisfied with the service they obtained. The Juniors greatly appreciated their reception.

Mr. HARRY CLARK (Senior Vice-President) seconded, and said they had much enjoyed the visit. The manner in which the fittings were tested after each process was remarkable. Distribution men appreciated this point very much. It was up to the gas industry to get rid of all obsolete fittings, and replace them with others such as they had seen made that day.

Mr. C. F. W. RENDLE supported the vote, which was heartily carried, and acknowledged by Mr. WILSON.

PERSONAL.

The PRESIDENT said that Mr. Frank R. Ayre, a well-known and popular member for many years of the Association, was with them as a member for the last time. Having accepted an important appointment outside the industry, the rules did not permit of his remaining a member. They much regretted this, but heartily congratulated him on the appointment he had obtained, and wished him every possible success in the future. [Applause.]

Constituents of Carburetted Water-Gas Tar.

There is an article in the November issue of "Industrial and Engineering Chemistry," by Messrs. Ralph L. Brown and Roscoe D. Howard, of the Pittsburg Experiment Station of the United States Bureau of Mines, in which they remark that little work has apparently been done towards the identification of the constituents of carburetted water-gas tar. In a previous paper by Mr. Brown, as Chairman of the Committee of the American Gas Association on Deposits in Gas Pipes and Meters, it was pointed out that the natural condensate—"drip oil"—taken from the distributing systems of carburetted water-gas plants in the United States contained indene and styrene in amounts totalling 40 to 50 p.ct. of the condensate. It follows as a corollary that these two hydrocarbons should be found in water-gas tar; and it is the belief of Messrs. Brown and Howard that the most intelligent and profitable utilization of these bye-products is possible when based upon the fundamental information of molecular composition of the tar and chemical properties of the constituents. From this point of view, and in the interests of the dissemination of knowledge, the authors have isolated, identified, and measured the indene and styrene in two typical samples of water-gas tar. Sample A. was a water-gas tar of specific gravity (20° C.) of 1·058, and low naphthalene, free carbon, and water content; while sample B. was of a specific gravity (20° C.) of 1·176, and contained, in comparison with the other sample, much naphthalene, free carbon, and water. In a table giving particulars of the experimental data, and including the following figures, the percentages are all based on 1000 c.c. of tar as sampled, and are in terms of volume.

Percentage of Tar Sample.

Sample.	Oils Boiling below 190° C.	Styrene.	Indene.
A.	5·3	0·7	1·9
B.	5·5	0·9	1·2

NORTH OF ENGLAND GAS MANAGERS' ASSOCIATION—AUXILIARY SECTION.

Half-Yearly Meeting.

The Ninth Half-Yearly Meeting of the Auxiliary Section of the North of England Gas Managers' Association was held in the office of the Newcastle and Gateshead Gas Company, Grainger Street, Newcastle, last Saturday afternoon, when Mr. W. L. ROBERTSHAW, of Sunderland, presided over a good attendance.

The CHAIRMAN moved that Mr. W. Batt, Jun., of Newcastle, be elected Chairman for the ensuing year; and that Dr. G. Weyman, of Newcastle, be elected a member of the Committee. He said that both gentlemen were very suitable for the offices they were to fill. Dr. Weyman was a member of the Committee of the North of England Gas Managers' Association, and would form a connecting-link between the Auxiliary Section and the main Association.

Mr. FORD seconded, and it was agreed to.

Mr. A. H. BAGSHAW (Hendon Gas-Works, Sunderland), Hon. Secretary, said Mr. Bernard Richardson, of Tynemouth, who was to give them a paper that day, had been ill for two months, and had not been able to prepare his paper until the last minute. It had therefore been written under great difficulties.

Mr. BERNARD RICHARDSON (Tynemouth) read a paper on

RECENT EXPERIENCES WITH EXTRACTION OF NAPHTHALENE, CORROSION OF MAINS, AND CAKING OF SULPHATE OF AMMONIA.

In the following notes it is my intention to deal as briefly as possible with some recent experiences gained in connection with the investigation of naphthalene removal, corrosion of service mains, and caking of sulphate of ammonia. Doubtless many of you will consider the first-named, at least, a hackneyed topic, though, I think, on the other hand, it will be admitted that, for some undertakings, trouble with naphthalene is still very rife, and the problem of its elimination an unsolved one.

At Tynemouth we came, in 1921, to the conclusion that the only satisfactory manner in which to deal with the naphthalene bugbear was to remove the hydrocarbon on the works, by treating the make of gas, immediately before it entered the holder, with some naphthalene solvent in a mechanical rotary brush scrubber. The solvent decided upon was gas oil, as it was found by experiment that the spent oil from the scrubber (containing 7 to 8 p.ct. of naphthalene) could, very advantageously, still be employed for carburetting water gas, as practically no increase in the naphthalene content followed upon its use. A description of this plant has already been given, so that it will be sufficient to remark here that complete naphthalene elimination can be effected by the use of water-gas oil to the extent of about 35 gallons per million cubic feet of gas treated. At times the figure has been as low as 15 gallons, and as high as 70 gallons, per million, but 35 gallons represents the average quantity used throughout the year. The maximum amount is required during hot weather, when considerable quantities of naphthalene, which have accumulated upon the undersides of the purifier covers, are volatilized by the heat of the sun beating down on the boxes. During the tropical period experienced at the beginning of last July, as much as 33·6 grains of naphthalene per 100 c.ft. were present in the gas at the inlet of the naphthalene washer. This, however, was reduced to a trace at the outlet, in spite of the fact that the wash oil in use was at a temperature of 70° Fahr. It is essential at such times to keep at least half the bays of the washer filled with fresh oil; otherwise there is a tendency for the oil in the final bays to evolve part of its absorbed naphthalene, especially if it contains 7 p.ct., or over, by weight.

Provided due regard is paid to supervision, it has been found that there is no difficulty at all in keeping down the naphthalene to less than 1 grain per 100 c.ft. of gas. A wash-bottle containing a saturated solution of picric acid is attached to a test cock fixed on the gas outlet main of the scrubber, and a stream of gas is continuously bubbled through. The presence or absence of a precipitate of naphthalene picrate after several hours determines whether or not sufficient oil is being supplied to the plant.

Our gas at the inlet to the holder carries, on the average, about half a grain of naphthalene, but at the outlet it invariably contains from 3 to 4 grains per 100 c.ft., thus indicating that appreciable amounts are being picked up in the holder itself. A year ago it was a common experience to find 10 grains at the holder outlet, even though the incoming gas was free from naphthalene; so that it seems as if the holder accumulations are gradually disappearing. Interesting results were obtained when testing the gas a short time ago, at points two and three miles distant from the works. At these stations it contained from 10 to 12 grains of naphthalene per 100 c.ft., whereas simultaneous tests carried out at the holder outlet and inlet showed 3·7 grains and a trace respectively. The scavenging effect of the naphthalene-free gas upon naphthalene deposits in the mains is clearly indicated.

The figures I have just given are interesting for another reason, in that they are considerably in excess of the theoretical quantity of naphthalene vapour necessary to saturate moist coal gas under the particular conditions of the tests. The explanation of this lies in the fact that a proportion of the naphthalene is present, not as vapour, but as exceedingly minute particles mechanically suspended in the gas. The presence of this naphthalene dust can be demonstrated by directing a beam of light upon a glass tube, kept in the dark, and through which gas containing over ten grains of naphthalene is allowed to pass. The sparkling of the naphthalene particles is easily apparent. I consider that it is these particles which initiate many of the stoppages occurring at the bends of service pipes, as there is a tendency for them to be deposited there, owing to the increased friction to which they are subjected at such points. Once deposited, they will act as convenient matrices for naphthalene vapour to crystallize on, if the temperature of the gas falls, just as a small crystal of alum, suspended in a saturated solution of the same salt, will initiate crystallization of the latter, and grow enormously in size.

Since the inauguration of the naphthalene extraction process at Tynemouth, stoppages due to the deposition of this compound have become negligible, and I think that we can fairly claim to have effected a satisfactory solution of the problem. It is true that naphthalene exhibits many vagaries in its behaviour; but, if these are carefully studied from a scientific standpoint, there should be no difficulty in coming to a complete understanding regarding them, and applying an appropriate remedy.

CORROSION OF MAINS AND SERVICES.

Most gas undertakings experienced much trouble from corrosion during the war years and the period immediately following, when it was not uncommon to find 2-in. and 4-in. cast-iron pipes almost completely choked by voluminous deposits which analyses proved to consist mainly of hydrated ferric oxide, together with smaller quantities of prussian blue or ferric ferrocyanide, ammonium sulphocyanide, ammonium sulphate, and traces of free sulphur. In many instances, also, large accumulations of fine black dust were found in high-pressure governors, which consisted substantially of the same compounds as were found in the low-pressure services, though the percentage of prussian blue was higher. In addition, samples of deposits were frequently recovered from lead pipes fixed to meter inlets. In these cases basic lead carbonate was the principal constituent.

With regard to the cause of these deposits, opinions are divided. On the one hand, we have those who maintain that the trace of hydrocyanic acid, now invariably present in town gas to the extent of 3 to 5 grains per 100 c.ft., is either the principal agent of corrosion or, in combination with ammonia, initiates the trouble, which is subsequently aggravated by the combined action of carbon dioxide, water, and oxygen in the gas. Others, however, hold the view that the last-mentioned constituents are the primary causes of corrosion, and that hydrocyanic acid takes a subsidiary rôle, merely combining with the hydrated ferric oxide to yield, after a complicated cycle of reactions, prussian blue.

Personally, I consider that the second view is the correct one, and that, on account of their small molecular concentration or "active mass," the hydrocyanic acid and traces of ammonia which are normally present in purified coal gas can do little harm; while, on the other hand, excessive amounts of oxygen and carbon dioxide are capable of causing serious damage to iron pipes in the presence of moisture; the latter constituent being invariably present. While I have found prussian blue to be present in the majority of cases of corrosion deposits, I have, nevertheless, met with very bad examples which have been practically free from cyanogen compounds. These are invariably freshly-formed deposits of rust, which fact seems to point to the conclusion that the crude prussian blue is formed subsequently by interaction with the hydrated oxide of iron.

Recent experience has shown in a striking manner that, if care be taken to keep the oxygen and carbon dioxide in town gas within reasonable limits (say, 0·5 p.ct. of O_2 and 2½ p.ct. of CO_2), trouble with corrosion deposits tends to become very much less acute, though it will always be present to some extent, since the gas of to-day does not contain sufficient heavy hydrocarbons of a nature to condense out upon the interior of mains and services, and so protect them from the deleterious effects of corrosive agents. Moreover, since the substitution of oxide of iron for lime in the purifiers, the bulk of the carbon dioxide formerly absorbed passes through the boxes into the town, and, in addition, the practice of revivification *in situ* has also had a tendency to increase the oxygen content of the gas. It is therefore not surprising that recent years have witnessed a large increase in the number of stoppages brought about by corrosive constituents. While recognizing the fact that it is not a practical proposition to supply gas entirely free from carbon dioxide and oxygen, it is nevertheless highly desirable to keep them as low as is compatible with economical working. If, further, it were within the realm of practical politics to desiccate the gas by some process as it leaves the works, corrosion troubles would become non-existent, for all the mischief which occurs under this heading is only possible in the presence of moisture.

The point, however, which I wish to emphasize before I leave this topic is that it seems futile for the gas engineer or manager to imagine that by eliminating hydrocyanic acid from his gas he is providing a cure for choked mains. If he is to obtain reasonable immunity from corrosion in the services, he must concentrate his attention upon the carbon dioxide and oxygen contents of the gas. By avoiding the inclusion of furnace gases at the retorts, and by remembering that not more than 0·5 p.ct. of oxygen is necessary to effect revivification of the purifier oxide, he can achieve much;

while, on the other hand, if he is convinced that the proper course to pursue is to instal an expensive cyanogen extraction plant, he may find, in the long run, that his last state is as bad as the first. The gas industry has one bogey in the shape of naphthalene. It is not necessary to conjure up cyanogen as a second.

THE CAKING OF SULPHATE OF AMMONIA.

This problem is, as I think you will acknowledge, a very live one for the gas industry at the present moment, when neutral salt is the order of the day, and considerable reductions in price are enforced if this contains lumps or if it cakes. I met a Yorkshire farmer some short time ago who was very annoyed with a certain consignment of sulphate he had received, which he maintained resembled concrete in consistency. He had to spend a considerable amount of time and labour in breaking it up, and preparing it for use. He was naturally somewhat biassed against sulphate of ammonia in general, and declared he would buy no more. On the other hand, I have found the neutral salt very well spoken of, though some have complained that certain varieties are so fine that on windy days it is most difficult to apply them to the land. It is manifestly incumbent upon sulphate producers to supply a material free from these defects, if competition with other types of manure is to be met, especially as the farmer of to-day is very keen at weighing up the disadvantages and advantages of the various nitrogenous fertilizers, and forming his own opinion upon them.

The caking of sulphate of ammonia, both in bags and in the store, must have been experienced at some time or other by all producers of the salt; the neutral variety not always being exempt from this defect. In the production of neutral sulphate the salt is usually ejected from the saturator into a centrifugal drier. Here, after a preliminary washing with a little water, it is treated either with ammoniacal liquor or ammonium carbonate in quantity sufficient to neutralize the free acid, and is whizzed for a specified time to extract as much mother liquor as possible. The remainder of the water is removed by drying the salt, either in a current of hot air or by causing it to pass through a steam-heated drier, which, while thoroughly desiccating the salt, should not destroy its crystalline structure. In some cases the salt is neutralized, dried, and ground in a pulverizer of the "Cordite" type after a preliminary treatment in the centrifugal drier.

A good specimen of neutral salt should exhibit a somewhat greyish colour, and ought to be practically dry and free from sulphuric acid; while, above all, it should not cake when put into the store or packed into bags. However, it will sometimes be found, even after all precautions have apparently been taken, and the salt shows a neutral reaction, with only 0·1 to 0·05 p.ct. of moisture present, that caking can take place. In these cases the trouble is, in all probability, due to the sulphate having been stored in a damp place or in a draught. Under such conditions the salt absorbs moisture from the air, which, combining with some of the sulphate, forms crystalline sulphates and binds the material together. Sulphate which has been treated in a "Cordite" machine, and finely ground, is exceptionally sensitive to hygroscopic changes, especially if a deliquescent neutralizing agent, such as soda ash, has been employed, and is present in slight excess. Traces of calcium sulphate, ferrous and ferric salts, phenolic bodies, and pyridine do not appear to aggravate caking.

Imperfect neutralization, resulting in the presence of free sulphuric acid in the dried salt, appears, however, to be the chief cause of caking. An examination of four samples of salt which showed strong tendencies to form hard lumps in the bags yielded the following results:

Sample.	Moisture. P.Ct.	Free Acid. P.Ct.
A.	0·092 ..	0·104
B.	0·275 ..	0·100
C.	0 080 ..	0·087
D.	0·06 ..	0·282

Another sample, which was dried and ground (but not neutralized) in a "Cordite" pulverizer, contained 0 5 p.ct. free acid, and on exposure to the air assumed, in a very short time, the appearance and the consistency of cement. The small amount of acid present, acting as a hygroscopic agent, readily absorbs moisture from the air, especially when the latter is very damp. The absorbed water will then exert a solvent effect upon the surfaces of the crystals, and cause them to adhere to each other. If the salt be then removed to a warm dry place, some of the contained water will evaporate, and cause a proportion of the dissolved sulphate to separate out in the solid form among the crystals, and so bind them more or less firmly together. It is therefore essential that careful supervision should be exercised over the neutralizing process, for very slight irregularities in working may give rise to considerable variations in the quality and properties of the finished product. Thus, for example, though the proper amounts of whatever alkaline reagent is employed may be added to the salt in the centrifugal drier, the latter may be operated at too low a speed at some particular period, so that neutralization is incomplete, and the production of a batch of unsatisfactory caking sulphate results.

Large grained salt is much easier to treat than is the fine crystalline variety, for, on account of its open texture, it allows the neutralizing agent freely and evenly to penetrate the whole mass, so that the process of neutralization is sooner carried out than is the case with the fine grained material. It is also necessary that the centrifugal drier should be kept in good condition, frequently cleaned, and the basket holes prevented from becoming clogged. Neutralizing the salt in a pulverizer of the "Cordite" type does not give a product which is entirely satisfactory. In this case the salt, after a preliminary treatment in the centrifugal machine, is fed into the pulverizer, and the requisite amount of soda ash or ammonium carbonate added. It is then subjected to a thorough mixing and grinding, while, at the same time, moisture is expelled by passing steam through the jacket surrounding the machine. It is highly desirable that the salt fed in should not contain more than 2 p.ct. of moisture, otherwise it becomes necessary to prolong the process, with the result that the crystal structure of the salt is almost entirely destroyed, and the final product is very dusty and difficult to handle, while the grain is so small that it has a tendency to pass through the bags into which it is packed. Such a salt is, moreover, liable to cake easily, as the particles of which it is composed are packed so closely that they are more easily cemented together than are the larger crystals.

The preparation of a satisfactory neutral sulphate of ammonia is, therefore, a matter calling for some care; and, if caking is to be avoided, it seems necessary that the following rules should be observed. First of all, conditions in the saturator should be so adjusted as to yield large crystals. Secondly, neutralization should be thoroughly carried out in a manner which does not destroy the crystals; and, thirdly, the neutral salt should be stored in a dry place, free from draughts, and maintained at an equable temperature. I have found pure dry sulphate of ammonia crystals cake badly when exposed to damp air, though they remained unaltered for weeks in a dry room. Upon this subject I should be very pleased to have your views, for it is only to promote discussion that I have put forward these few facts and ideas.

In conclusion, I desire to thank the Directors of the Tynemouth Gas Company, and Mr. F. C. Willis, the Chief Engineer, for permission to publish figures relating to the naphthalene extraction plant.

Discussion.

The CHAIRMAN congratulated Mr. Richardson on his interesting paper, particularly as it referred to naphthalene and sulphate of ammonia.

Dr. WEYMAN thought the remarks of Mr. Richardson concerning corrosion were very near the truth. In recent years, he said, everybody had turned his attention to reducing naphthalene stoppages; and it was found that they were getting over the difficulties very well. He thought that a great many of the stoppages were, to a certain extent, caused by the products of corrosion, accentuated and finished off, as it were, by naphthalene. As to sulphate of ammonia, he thought it was up to them to give the farmer the texture he required.

Mr. BAGSHAW said the thanks of the Auxiliary Section were due to Mr. Richardson for the valuable hints he had given. At Hendon they had installed a naphthalene plant whereby they had carried out complete extraction. They found the gas oil efficient. They started with 40 gallons per million c.ft., afterwards reducing this to 30 gallons.

Mr. W. E. OULDS (Tynemouth) referred to the naphthalene extraction plant at his works, and said they had not seen any naphthalene in their distributing system. Most of the troubles began with the distribution of war-time gas.

Mr. J. E. MORFETT touched upon methods for preventing external corrosion of pipes. At his works, they made the pipes last longer by wrapping them with "home-made" material. The pipes were immersed in a solution, wrapped in cloth, and then re-soaked. This made an excellent preservative coating.

Mr. RICHARDSON, in reply to the discussion, said at Tynemouth they did not claim to have discovered anything very wonderful for the removal of naphthalene. In the past, their methods of dealing with the subject had been mostly empirical, and scientific laws had been ignored. Naphthalene was present in very small quantities in town gas, and to remove it they had to remember that the gas required drastic washing in an extraction plant.

Mr. F. J. COLMAN, of Wear Tar Works, Sunderland, then read a paper on

PETROLEUM.

The subject is dealt with by the author in a comprehensive manner. Commencing with an outline of the history of the petroleum industry, the problem of the origin of petroleum is considered, mention being made of the inorganic and organic theories—the subject of scientific controversy for many years. As evidence of the organic theory, research work has been done by Dr. Bergius on the hydrogenation of coal. By treating any coal containing a fair percentage of volatile matter with hydrogen, under high pressure and at temperatures up to 850° Fahr., an exothermic reaction is induced, and a portion of the solid fuel becomes liquefied, giving as a result a product similar to heavy crude petroleum. In support of the inorganic theory, it is known that hydrogen and carbon dioxide occur as natural gas in the earth; also that, in the presence of a nickel catalyst, they unite to form methane at comparatively low temperatures and pressures, and higher hydrocarbons at increased pressures and temperatures. Nickel is present in petroleum, and largely composes the ash of crude oils. In the oils found by hydrogenizing coal, ammonia and phenols are always present. These substances are not found in petroleum.

The author then discussed the production of the oil. The method generally used for drilling the wells is the rotary system. A rigid stem of heavy pipe rotates a fish-tail drilling bit at the

bottom of the hole, cutting and stirring up the formation to be drilled. It cuts its way through the underground formations, much in the same way as a screw, when rotated, forces its way through wood. It is the essence of speed in drilling, for, unlike percussion methods, the drill does not have to be lifted for the purpose of clearing. The pulverized earth is continuously washed from the hole by a stream of water reaching the bottom of the drill. Very frequently a pressure-fed mud is used, and this serves a double purpose, for in its return to the surface it tends to plaster the walls of the well. The mud emerges in streams of high velocity from the two apertures in the drilling bit. An approximate average for the drilling of a well is about 600 ft. per month. An estimate of the power used for working the drills has been made as follows: 60 p.ct. of the oilfields use steam; 35 p.ct. oil and gas; and only 5 p.ct. use electricity.

In no commercial operations has there been greater waste of the resources of nature than in oilfield development. Initial operations in new oilfields, where uncontrolled work was allowed to proceed without criticism, has led to hundreds of thousands of tons of petroleum being lost by fires, evaporation, or dissipation. Millions of barrels of oil have been deliberately burnt as the most economical way of disposal; and many millions of tons of oil could have been saved by simple remedies. The waste of natural gas has been tremendous; and a rough estimate of ten to twenty million cubic feet daily has escaped when prospectors in search of oil struck gas. Natural gas was daily wasted in some of the American fields to the extent of 70 million c.ft., equal in heating value to 1500 tons of crude oil. In recent years it has been the practice at many of the wells to condense the oil-gas vapour into motor spirit. Some plants are condensing 3 million c.ft. daily. It is estimated that America produces from oil-gas condensation, on an average, 150 million gallons of motor spirit per annum.

After a consideration of oil transportation, the author dealt with the distillation of the crude product. At a modern plant this is generally done by some continuous process. The oil often flows by gravity from tanks placed on a hillside, through various heat exchangers into stills. The additional heat required for distillation temperature is generally some form of oil residue which is burnt under the stills. The crude oil is preheated by means of the residual oil from the distillation. The first distillation is usually to take-off the crude-petrol fraction; and the remainder can, of course, be used entirely as a fuel oil. If it is necessary to continue the distillation, this takes place in other stills, where paraffin, gas oil, and heavy oil are produced. In this distillation stage, use is made of highly superheated steam injected into the stills, to reduce the working temperature, and to keep the viscous fluid in a state of motion. It assists the removal of the heavy distillates, and carries them away from the still with less cracking. When the heavier lubricating oils are required, it is often the procedure to transfer the residue to another special type of still, when, in addition to steaming, a partial vacuum is maintained, to diminish the temperature of distillation and avoid decomposition and burning. The refined products in the order of their production by distillation are: Motor spirit, paraffin, gas oil, lubricating oils, fuel oils, residuum, &c. At some refineries, the distillation is continued until nothing but coke remains. It is also possible to take the distillation to a point where the residue, if run out and allowed to cool, has an appearance and melting point similar to coal-tar pitch. Generally, it is very bright in appearance, owing to the absence of free carbon. Vacuum in the distillation of petroleum, and even of coal-tar and and its products, has not received the attention it deserves. Its advantages are: Less cracking or decomposition; distillates of a higher flash point and better colour. The residues are also of better quality, owing to there being little or no free carbon. Vacuum distillation plants are more costly as regards capital outlay and wages, but this may easily be counterbalanced by the larger yield of better products requiring less chemical treatment, and longer life of the plant.

The rest of the paper dealt with refining, solid paraffin extraction, candle manufacture, vaseline production, and other matters of general interest—such, for example, as the use of exceedingly light distillates as anæsthetics.

Discussion.

The CHAIRMAN said the amount of subject matter in Mr. Colman's paper was amazing. The oil production of the world for last year was 112 million tons, whereas the coal production of the United Kingdom was about 5 million tons per week.

Mr. G. WICKNER remarked that the petroleum industry was interesting to those in the gas industry. They were proud of the fact that their motor spirit gave more power than petrol.

Dr. WEYMAN said the paper had served a very useful purpose. He referred to the work of Dr. Bergius, and said he thought the future might see this work developed.

On the motion of Mr. WICKNER, seconded by Mr. G. HEATHERINGTON (Birtley), a vote of thanks was accorded to the speakers.

Institution of Mining Engineers.—The 34th annual general meeting of the Institution will be held in the Rooms of the Geological Society, Burlington House, Piccadilly, W., on Thursday, the 29th inst., under the Presidency of Sir John Cadman, K.C.M.G. Four contributions will be submitted, one being by Mr. G. Coles, B.Sc., on "The Specific Heat of Coal" (eighth report of the Committee on the Control of Atmospheric Conditions in Hot and Deep Mines).

YORKSHIRE JUNIOR GAS ASSOCIATION.

Papers on Coal Testing and Maintenance of Appliances.

A Meeting of the Association was held last Saturday, Nov. 17, at the Library of the "Y.M.C.A.," Leeds, when the PRESIDENT (Mr. W. Heathcote, of Halifax) presided over a good attendance.

Mr. C. H. CHESTER, F.C S., of Southbank, read the following paper:

CLASSIFICATION AND TESTING OF COAL.

That coal is the product of decayed plant life is the history generally accepted, and we may therefore define coal as a compact mass of "mummified" plants (which have in part suffered decay in varying degrees of completeness) with a slight contamination of other matter. The obvious deduction is, therefore, that it is an organic complex, and has various molecules which should bear some relation to the molecules of the organic substances of the plants from which they originate. Hence the basis of carbon, hydrogen, oxygen and nitrogen, and traces of minerals—such as iron, phosphorus, sulphur, and others, set free or still in molecular combination.

The difference in the amount of free carbon is undoubtedly due to the variance in intensity of the chemical reaction due to the pressure and the heat generated in the earth's crust. The celluloses, which form such a large proportion of plant life, are represented identically; and there are those resulting from bacterial decay or polymerization. The "resinic" portions of coal present a different aspect, however, owing to their resistance to bacterial decay; and the deduction must therefore be that they proportionally increase while the plant life is accumulating and decaying in the early stages of coal formation.

Many tests can, of course, be undertaken in the detailed classification of coal; but, in the time at my disposal, I must confine myself to a brief outline, although their study is both fascinating and useful. Most of these tests are merely empirical, and must be calculated to a basis of carbon, hydrogen, and oxygen; or they will be useless, owing to the fact that ash, moisture, and other traces mask their true proportion.

Dealing first with oxygen, it is known that it has marked effects on volatile matter, gas and coke yields, and CO and CO_2 contents. The late Prof. Lewes gives the following analyses as representing three distinct types of coal, from which you can make your own deductions.

—	Gas Coal.	Steam Coal.	Anthracite.
Carbon	80 to 85	75 to 80	90 to 93 p.ct.
Hydrogen	5 to 5·8	4·5 to 5·5	4 to 4·5 ,,
Oxygen	10 to 14·2	15 to 19·5	3 to 5·5 ,,

An application of these tests to Seyler's classification shows at a glance the class to which a coal belongs.

Humic bodies—namely, the degradation products of cellulose—together with the resinic constituents, influence the production of coke, gas, and tar. Coking power is due to the tar derived from the resins and hydrocarbons in the coal, which on heating leave the pitch by which the coke is luted together. The tar from the humic bodies is not easily decomposed, and leaves behind but little pitch on carbonization.

Hypothetically, gas coal and coking coal will contain the following proportions, according to Gruner.

—	Carbon Residuum.	Humus Bodies.	Resin Bodies.	Hydrocarbons.
Gas coal	25	25	25	25
Coking coal . . .	30	10	30	30

From these figures you will see that resin bodies and hydrocarbons have to be present in the proportion of at least 50 p.ct. for the coal to have coking properties.

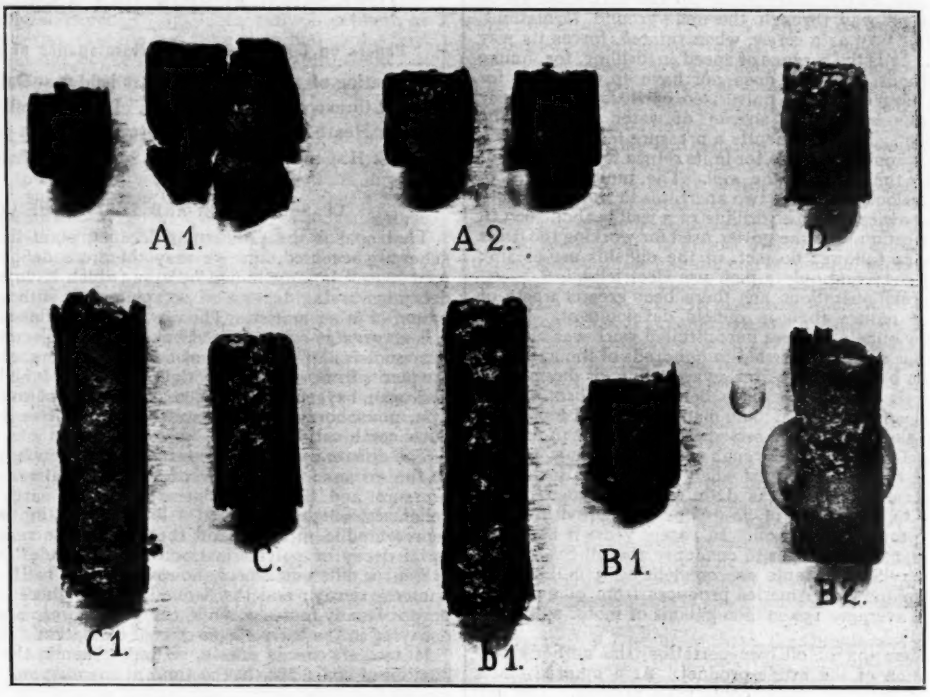
According to Lewes, the following are the analyses of these:

Residuum.	Humus Bodies.	Resin Bodies.	Hydrocarbons.
Carbon	Carbon 62 Hydrogen 5 Oxygen 33 Gives watery phenoloid tar.	79 11 10 Rich oily tar.	9 4 *Nil* Heavy viscid tar.

Summarizing, therefore, I think that, if we are to probe further into the analysis of coal than we generally do in gas-works to-day, determinations of the carbon, hydrogen, and oxygen should be made.

These bodies are tested by extraction, and the solvents most generally in use are pyridine and phenol; while chloroform, ether, and aniline are also used. Pyridine is preferred, owing to the fact that it renders subsequent examination easier.

The use of the word "bituminous" as applied to gas coals is erroneous, except in its broadest sense, indicating as it does



A_1. Washed Treble Nuts, 3 in. A_2. Washed Double Nuts, ¾ in. to 1¼ in. B_1. W. Yorks. Rough Small, below 1¼ in. b1. Without Piston. B2. W. Yorks. Peas ⅝ in. Same seam as B1. C. Durham Rough Small, 1¼ in. C1. Without Piston. D. W. Yorks. Pea Slack, ⅝ in., and below.

"bitumen." It has become a trade name, but really it is the hydrocarbons and resins which give rise to this name.

SAMPLING.

In sampling, too much care cannot be taken. A large sample should be taken initially, and this quartered down as soon as possible, in the usual way, to a convenient sample for the laboratory. A good method is to take a sample as the coal falls from a truck, and so get a proportionate amount of "fines" with lumps. The surface of a heap is rarely a true representation of the bulk.

MOISTURE.

This test is carried out in a glazed porcelain dish, in which one gramme of powdered coal is heated for one hour in an oven at 105° C.; the temperature being obtained by a mixture of equal proportions of glycerine and water. After exactly one hour it is allowed to cool in a dessicator, and weighed. Though the coal subjected to this treatment is liable to oxidation, it is the usual method, and answers all practical purposes.

VOLATILE MATTER.

A gramme of coal is taken for this test, powdered to pass a 30 I.M.M. standard sieve. The test is carried out in the Lessing apparatus. It is necessary for standardization that coals used in testing should be of a uniform size. This has an important bearing on the ultimate appearance of the coke (referred to later). This test gives, by the way, a lot of useful information in the one operation. An example is given in my paper before the North of England Gas Managers' Association in May, 1921.

The apparatus consists of an electrical furnace accommodating two cylindrical quartz retort tubes with walls of uniform thickness and having necessarily definite dimensions. The coal sample is compressed during the heating, by a quartz piston loosely fitting in the retort tube, so that only gas and tar vapour, but no coal dust, can pass between it and the retort walls. The position of the tube in the furnace is fixed by a height-adjusting attachment, which carries two plain inverted tubes, on which the retort tubes rest. The gas passes from the retort tube by means of a side tube through a small glass scrubber condenser filled with cotton wool, which retains the tar, into a eudiometer of 300 c.c. capacity, provided with a levelling bottle.

A test is carried out as follows: The furnace is first brought to the requisite temperature, which is regulated by an outside resistance. By observing the reading of the ammeter, a known temperature is obtained. The coal is placed in the retort tube and the piston gently inserted by means of a wire hook in the loop provided, care being taken not to disturb coal dust, which may get jammed between the piston and the tube wall. The tube is closed by a rubber stopper; the side tube of the scrubber condenser is fitted with a rubber connection which is slipped over the retort tube, care being taken that gas is practically not in contact with the rubber; and the scrubber is connected by glass tubing to the eudiometer. Adjustment is made so that the charge of coal will be in the hottest part of the furnace. The liquid in the eudiometer is then brought to the top, and connected to the retort by means of the three-way tap, and the retort carefully inserted in the furnace. The progress of gasification is followed with a stop watch. Volumes are read every thirty seconds. The test, carried out at 900° C., is completed in seven minutes. This temperature is obtained by the adjustment of the outside resistance to a known amperage checked by a pyrometer. The tube, still connected, is then lifted from the furnace and allowed to cool, the final reading taken at room temperature, and adjustment made to N.T.P.

After cooling, the retort tube and scrubber are disconnected and the piston removed, assisted if necessary by slight tapping. The coke cylinder is turned out, also the carbon (which latter is due to decomposition, and is really part of the tar), and the two are weighed separately. The volatile matter is then calculated.

To estimate the tar yield, the retort tube is washed out with a little benzene. This is filtered free from carbon, which is added to the other carbon, and then used for extracting the tar from the scrubber condenser. The bulb of the latter contains the bulk of the tar. The liquor is extracted by filtering the solution through a dry filter. The filter is washed with the solvent used for the extraction, and the residue from evaporating the combined filtrates and washings is weighed, and gives a fair and comparative measure of the tar yield.

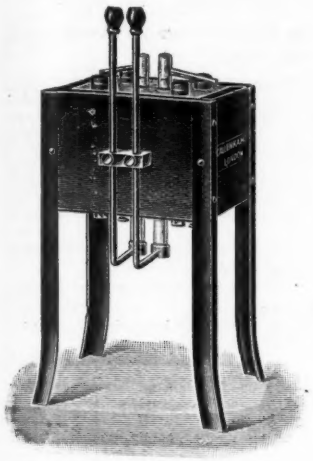
The coke cylinder is kept for reference, and the tabulation of the results, combined with judicious judgment and study, gives a fair indication of the subsequent behaviour of the coal under actual working conditions.

I would draw your attention particularly to the photograph showing crucible and Lessing cokes from the same coals and from which you will see at a glance which method is open to greater error. Indication as to whether or not a coal cokes well is readily seen by heating at 400° C. A good coking coal will give a coke at this temperature—true, a fragile one.

As the proportion of volatile matter increases above 30 p.ct., the coking power is lowered, and as it decreases down to 15 to 20 p.ct there are no coking properties, due to the very small percentage of resinic bodies and hydrocarbons.

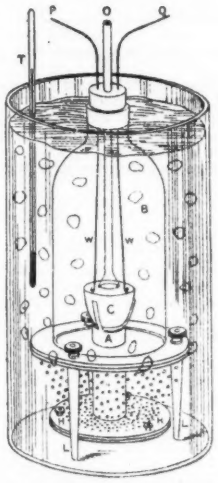
For this test I have also had my attention drawn to an apparatus designed by the Fuel Research Board, which is a slight elaboration (in my opinion) of the method of Dr. Lessing. The apparatus is fully described in Technical Paper No. 1 of the Fuel Research Board. As far as I can see, the main difference is that the Lessing apparatus allows of decomposition to some extent, though not so much as the crucible method, while that of the Fuel Research Board aims at avoiding this decomposition. In my opinion the Lessing is the apparatus nearest to our practical experience, which you will admit allows of decomposition, and it is therefore preferable for standardization; moreover, it is least liable to error in the hands of different operators. On the other hand, you may say that the Fuel Research Board apparatus is preferable on the score that it deals with larger quantities (15 grms.). By striking a weight balance the whole operation in each case can be checked.

In further support of my view of standardization, I would say that tests made with the same coals at the same temperature, &c., by Dr. Lessing in his apparatus corresponded almost exactly

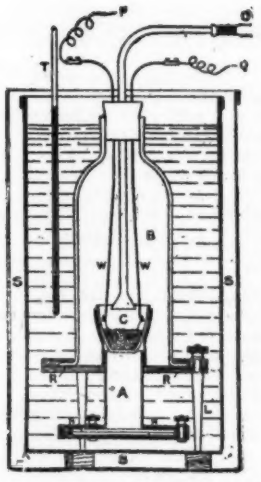


No. 1. Lessing Electric Furnace.

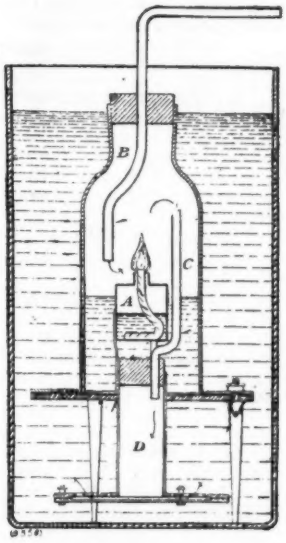
No. 2. Electric Muffle.



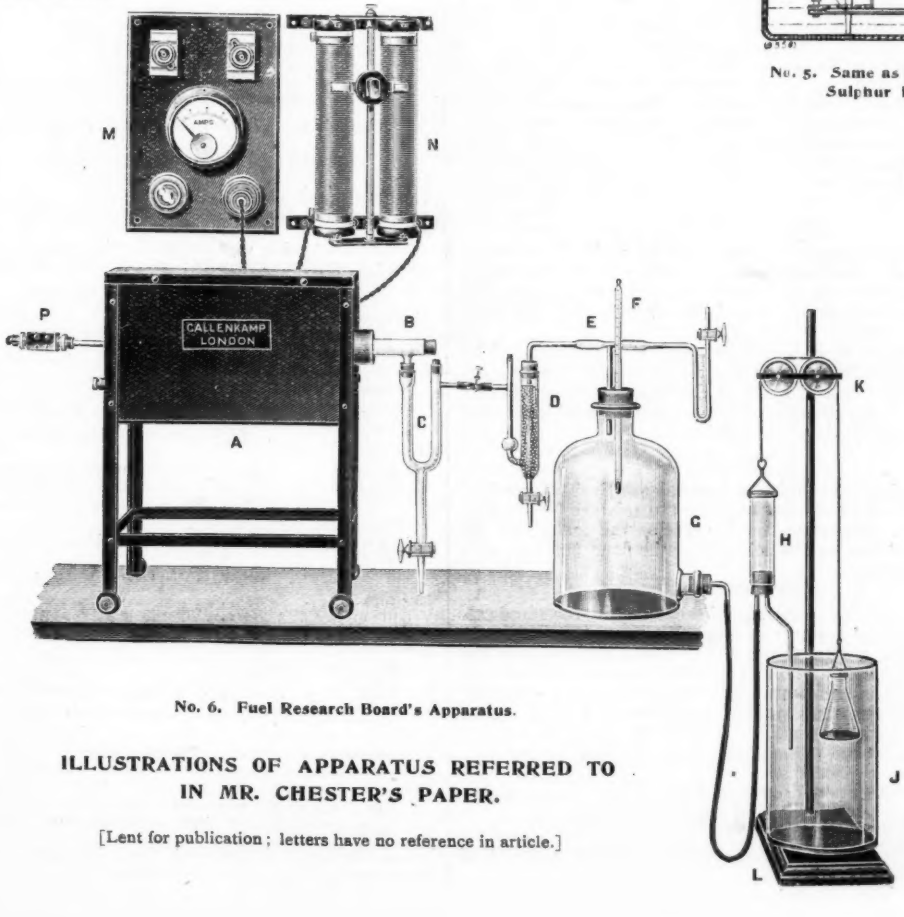
No. 3. Darling Calorimeter in Glass Vessel, Electric Ignition.



No. 4. Same as No. 3, but with Copper Vessel.



No. 5. Same as No. 3, but with Sulphur Ignition.



No. 6. Fuel Research Board's Apparatus.

ILLUSTRATIONS OF APPARATUS REFERRED TO IN MR. CHESTER'S PAPER.

[Lent for publication; letters have no reference in article.]

in every way with tests taken by Dr. Davidson on a large experimental scale at the Birmingham gas-works testing station.

Calorific Value.

For the determination of calorific value I use a Darling calorimeter; and while realizing that it is not a standard, in the hands of a careful operator it will give concordant results, which are, after all, what we want for indication purposes. By it you have to make your own standard. It is easy of operation; moreover, it is very cheap, compared with the more elaborate ones, which never give really accurate results, being subject, as in this case, to radiation losses, but to a minor degree.

Method of Operation.

One gramme of coal is weighed into a nickel crucible, 1400 c.c. of water about 2·5° C. below room temperature are poured in the vessel, the crucible is placed into position, the glass cover fastened down air-tight, a rubber cork inserted, so that the ignition wire is embedded in the fuel, the oxygen is turned on, and the apparatus immersed in the water. The temperature of the water is noted, and the battery circuit completed. As soon as the fuel is ignited the battery is disconnected, and combustion proceeds slowly. The oxygen is allowed to continue passing until no further rise in temperature takes place. The precautions necessary are: (1) Not to allow too rapid an oxygen stream, which would dislodge coal; (2) no smoky flame should be visible showing unburnt carbon, rendering test valueless; and (3) care that combustion is complete—*e.g.*, the crucible is visibly red hot near end of combustion. The calculation is made as follows—

$$\text{C.V.} = \frac{(\text{weight of water} + \text{water equivalent}) \times \text{rise in temperature}}{\text{weight of fuel taken.}}$$

1 c.c. of water taken as weighing one gramme.

The Fahrenheit reading expresses the result as B.Th.U. per lb. of fuel, the Centigrade as calories per gramme. Evaporative power is obtained by dividing the latter (calories per gramme) by 537 (representing the latent heat of steam).

The reason for commencing below room temperature is to obviate largely the errors due to radiation.

To conserve time I shall not read the figures of tests taken, but would draw your attention more particularly to the consistently good results, borne out in practice, obtained with coals A, B, and C; the first two being West Yorks, and the latter Durham. Coal A is particularly suited to the Tully plant, and has never given trouble during its use extending over two years or so. Coal D tests go to emphasize more clearly the necessity for checking deliveries. All results for comparative purposes are calculated to ash-free dry basis.

Ash.

In the determination of ash I still use the older method of burning-off over a Méker burner in the absence of draught, which precaution is necessary to prevent loss, though of course there are more elaborate methods by muffles. Subsequent examination of the ash is desirable, and bears considerably on behaviour in practice—*e.g.*, fluxing effect, presence of iron and lime being the more important (see tests). From these tests of ash I hope, as research is made, it may be possible to classify coals into their various banded constituents—clarain, vitrain, durain, and fusain—and then the discovery made by Dr. Marie Stopes will be all the more valuable, as the ashes from these present their own peculiarities. Here, of course, the microscope will play an important rôle.

Coking Index.

The agglutinating power test can well be undertaken in the Lessing retort tube, ensuring more uniformity; the method being the well-known admixture of carbon or sand and the use of a weight after carbonization. A definite size of coal and inert matter must be used.

Coking power of coal is known to be affected and reduced by heat treatment at 500° C.; and I am of opinion that the question is treated on a commercial scale in the Tully plant, which may account for the fact that some coals are workable which logical conclusions from analysis would condemn.

Sulphur.

For the determination of this, for convenience Eschka's method is probably the best, using care to check the mixture for the presence of sulphur. An estimation is made on the coal giving the total sulphur, and one on the coke giving the fixed sulphur, with volatile by difference.

Conclusion.

I make no apology for reiterance of the necessity for standardization and pooling of results; and the sooner we are working in collusion the better for our industry, in which a knowledge of the coals we use plays such an important part if we are to know how to treat them. It is a lamentable feature of present-day commercial conditions that so often analyses presented by colliery agents and proprietors cannot be regarded as useful data from the buyers' point of view, and have of necessity to be checked by our own individual laboratory procedure.

I shall be glad of a good discussion, which may at any rate give us some grounds on which to standardize beneficially.

I desire to thank Messrs. A. Gallenkamp & Co., Ltd., of London, for the loan of the photographs of apparatus referred to in this paper.

RECORD OF TESTS REFERRED TO.

From North of England Gas Managers' Association, May, 1921.

Elphinstone Mixed Nuts, Pieces up to 2½ in., rather Dusty. Dull, Soft Coal, easily Broken.

	Proximate Analysis.		Ash Free Dry Coal.
Moisture	12·68	Volatile matter	38·90
Volatile matter	32·42	Fixed carbon	61·10
Fixed carbon	50·92		
Ash	3·98		
	100·00		100·00

Analysis of Ash.

—	HCl Soluble Inclusive Water Soluble.	HCl Insoluble.	Total.
Silica	..	40·98	40·98
Alumina	8·02	22·96	30·98
Ferric oxide	10·86	2·08	12·94
Lime	1·72	0·66	2·38
Undetermined (alkalis, sulphuric anhydrides, &c.)	9·74	2·98	12·72
	30·34	69·66	100·00

Ratio alumina/silica, 0·76.

Coke from crucible test sintered, contracted, not expanded.

Colour of ash, light pink.

The character of the coke indicates that the coal does not tend to "hang-up" in the retort; and this was borne out in practice.

The high percentage of acid-insoluble in the ash, together with the moderate iron and lime percentage, shows that this coal should be suitable in producer work, and should not give clinkering troubles.

Coking test in the Lessing electric coking furnace gave the following results:

Temperature of coking	900° C.
Duration of heating	7 mins.
Coke	55·14 p.ct.
Carbon	1·98 ,,
Coke *plus* carbon	57·12 ,,
Tar	12·04 ,,
Gas N.T.P.	214 c.c. per gramme, or 7638 c.ft. per ton.

Coke well sintered, not expanded.

Volume of Gas after— Mins. Secs.	C.C. per Gramme (Uncorrected).
0 15	6
0 30	18
1 0	50
1 30	86
2 0	126
2 30	168
3 0	196
3 30	207
4 0	214
4 30	219
5 0	223
5 30	227
6 0	229
6 30	232
7 0	234
Volume after cooling	232

Coal A. 1. *3 in. Washed Treble Nuts. March* 13, 1922.

As Received.		Ash-Free Dry Basis.		Coking Index.	B.Th.U. Lb.
Moisture	9·32	—	—	—	—
Volatile matter	26·84	Volatile matter	30·22	—	—
Fixed carbon	61·96	Fixed carbon	69·78	4	12,703
Ash	1·88	—	—	—	—

Colour of ash, white with pink specks; inference, little clinker.

Coke sintered, not expanded; dull grey-black, no sign of surface fusion.

Same Coal, Oct. 17, 1923.

Moisture	6·75	—	—	—	—
Volatile matter	29·60	Volatile matter	33·45	—	—
Fixed carbon	58·90	Fixed carbon	66·55	4	13,046
Ash	4·75	—	—	—	—

Ash and coke similar to above.

Coal A. 2. *¾ in. to 1¼ in. Washed Double Nuts, same seam as A.* 1. *March* 13, 1922.

Moisture	10·9	—	—	—	—
Volatile matter	29·94	Volatile matter	34·58	—	—
Fixed carbon	56·64	Fixed carbon	65·42	3·5	12,098
Ash	2·52	—	—	—	—

Colour of ash similar to A. 1.

Coke sintered, not expanded; dull grey-black, small sign only of surface fusion.

Same Coal, Oct. 16, 1923.

Moisture	4·85	—	—	—	—
Volatile matter	32·50	Volatile matter	35·32	—	—
Fixed carbon	59·50	Fixed carbon	64·68	3·5	12,609
Ash	3·15	—	—	—	—

Ash and coke similar.

Coal A. 3. *4 in. to 5 in. Cubes, Clean Coal, same seam as Treble and Double Nuts Above.*

Moisture	7·0	—	—	—	—
Volatile matter	7·9	Volatile matter	31·14	—	—
Fixed carbon	61·7	Fixed carbon	68·86	4·5	12,859
Ash	3·4	—	—	—	—

Colour of ash similar to A. 1 and A. 2.

Coke not so well sintered, slight tendency to hang-up borne out in practice: grey, slightly fused surface.

Note peculiarities of these coals from same seam. Perhaps size of coal has something to account for in practice.

Coal B. Jan. 13, 1923. *Rough Small, 1¼ in. and under.*

Moisture	2·8	—	—	—	—	—	
Volatile matter	30·8	Volatile matter	33·84	—	—	—	
Fixed carbon	60·2	Fixed carbon	66·16	7			12,968
Ash	6·2	—	—	—	—	—	

Colour of ash, greyish brown; inference, little clinker; presence of small percentage of iron and lime.

Coke slightly expanded, but well coked; good dense coke, steel grey, strong lustre, and fused surface.

Same Coal. April, 1923.

Moisture	2·0	—	—	—	—	—	
Volatile matter	30·0	Volatile matter	32·75	—	—	—	
Fixed carbon	61·6	Fixed carbon	67·25	7			12,978
Ash	6·4	—	—	—	—	—	

Ash and coke similar to above.

Same Coal. Oct. 17, 1923.

Moisture	5·0	—	—	—	—	—	
Volatile matter	29·5	Volatile matter	34·30	—	—	—	
Fixed carbon	56·5	Fixed carbon	65·70	7			13,033
Ash	9·0	—	—	—	—	—	

Ash and coke similar to above.

Coal C. Rough Small, 1¼ in. and under. March 15, 1922.

Moisture	1·94	—	—	—	—	—	
Volatile matter	28·56	Volatile matter	29·91	—	—	—	
Fixed carbon	66·92	Fixed carbon	70·09	7·5			12,986
Ash	2·58	—	—	—	—	—	

Colour of ash, light pink; inference, little clinker; small amount of iron.

Coke swells slightly, and is strongly coked; lustre, slightly fused surface, black.

Same Coal. Jan. 11, 1923.

Moisture	3·6	—	—	—	—	—	
Volatile matter	28·8	Volatile matter	32·21	—	—	—	
Fixed carbon	60·6	Fixed carbon	67·79	7·5			12,848
Ash	7·0	—	—	—	—	—	

Ash and coke similar to above.

Same Coal. Oct. 18, 1923.

Moisture	1·75	—	—	—	—	—	
Volatile matter	30·50	Volatile matter	32·70	—	—	—	
Fixed carbon	62·75	Fixed carbon	67·30	7·5			12,962
Ash	5·00	—	—	—	—	—	

Ash and coke similar to above.

Coal D. ⅜ in. Pea Slack. Dec. 22.

Moisture	3·60	—	—	—	—	—	
Volatile matter	30·00	Volatile matter	36·06	—	—	—	
Fixed carbon	53·20	Fixed carbon	63·94	6·5			11,981
Ash	13·20	—	—	—	—	—	

Colour of ash, greyish brown—clinkering properties. Good dense coke, not expanded; silver-grey, strong lustre, fused surface.

Same Coal. March 23.

Moisture	3·8	—	—	—	—	—	
Volatile matter	26·6	Volatile matter	34·10	—	—	—	
Fixed carbon	51·4	Fixed carbon	65·90	*Nil*			10,601
Ash	18·2	—	—	—	—	—	

Colour of ash similar.

Coke useless, does not bind, dull grey-black.

Coal E. Rough small 1¼ in. and under. July 26, 1922.

Moisture	2·2	—	—	—	—	—	
Volatile matter	27·4	Volatile matter	30·51	—	—	—	
Fixed carbon	62·4	Fixed carbon	69·49	—			12,921
Ash	8·0	—	—	—	—	—	

Colour of ash dark grey, no clinkering properties.

Coke swells slightly, but is strongly coked; fused surface, steel grey.

One pit unscreened, large lumps down to fines. Aug., 1922.

Moisture	1·6	—	—	—	—	—	
Volatile matter	27 6	Volatile matter	29·98	—	—	—	
Fixed carbon	66·0	Fixed carbon	70·52	—			13,103
Ash	4·8	—	—	—	—	—	

Colour of ash, light brown. Small percentage of iron. Little clinker.

Coke swells, but is strongly coked. Similar to above.

N.B.—The difference in ash is very noticeable; proof that fines are not similar to large coal of same seam always, or probably it is a varying seam.

Retort carbon taken for all index tests as inert material.

Discussion.

The PRESIDENT said they might congratulate Mr. Chester on a very fine paper. It was most important that the chemist should make periodical tests of the coals purchased. The purity of the coal had an important bearing on the value of the bye-products, and on the costing of the undertaking, for the question of the residuals entered very largely into the situation.

Mr. J. B. BALMFORTH (Bingley) commented on the fact that Mr. Chester had dealt entirely with laboratory tests. Personally, he (Mr. Balmforth) preferred the practical works test through the retorts—a test of one or two trucks of coal. The difficulty with laboratory tests was to be sure of getting a fully representative sample of the coal as a whole. In such determinations, they took something like a cubic inch; but if it was not really representative of the bulk, the whole issue was erroneous, and one got an entirely misleading idea of the value of the coal. He agreed that there was much value in a laboratory test, and thought the best plan was to make both tests, where practicable. It must be admitted that the gas industry was much behind-hand in the matter of tabulating tests of the various coals, and broadcasting the results through the industry, for the general benefit. When they considered the vast amount of coal used in gas-works, it was remarkable that there was not a more widespread system of distribution of works and laboratory tests of typical coals through some such organization as the Institution of Gas Engineers. Mr. Frank Robinson, the Manager of the Harrogate Gas Undertaking, and the Institution's representative on the Council of the Yorkshire Junior Gas Association, had tabulated a number of tests, and distributed them through the agency of the Yorkshire Commercial Section of the Institution; and these had been very valuable in showing the volatile matter, the nature of the coke, &c. Where a manager could not test for quality of coal, it would be very beneficial if there were a system of pooling tests.

Mr. F. CLEGG (Huddersfield) thought very much on the lines of Mr. Balmforth. He would like Mr. Chester to say whether he considered a laboratory test really as good as a practical works test. Personally, he hardly thought it was quite so satisfactory. He had been looking up some tests taken on the works ten years ago. There were two beds of three iron retorts in each, and the tests through these retorts gave very satisfactory results. There had been laboratory tests made previously, and they had not been entirely satisfactory; they certainly varied a little from the practical results. They had tested for the volume of gas to be got from the different coals. At that time they tested for illuminating power, the sperm value per ton, the calorific value per cubic foot, the coke quality, specific gravity of the liquor, &c. His own acquaintance had been entirely with practical works testing. Looking through the results, he thought they could be regarded as fairly good—about 60 to 67 therms per ton, from iron retorts, with no exhausters—no pulling of any kind. The practical test gave the engineers a better guide to quality of coal; and it also served to help to check deliveries as they arrived. In the testing to which he referred they used to get a couple of bags of coal from each consignment. They put in about ¾ cwt. per charge, and obtained results showing the physical nature of the coke, which was further tested for the amount of ash—this latter being done, as Mr. Chester had mentioned, in a muffle furnace. He would like Mr. Chester to say whether he preferred the laboratory test or the test on works lines.

Mr. W. INESON (Bradford) asked whether Mr. Chester had any particular method of testing the monetary value of the coal.

Mr. J. B. PRESTON (Liversedge) inquired why Mr. Chester carbonized at 900° C., when it must be remembered that temperatures were usually a good deal higher than this in modern retorts?

Mr. A. H. CLUCAS (Leeds) was of opinion that the great thing was to keep constant the human element in testing. The larger the quantity of coal used for the test, the more the risks attendant on the human element entered into the matter, and the greater the chances of error; whereas in a laboratory test the conditions of working were calculated very exactly, and the only difficulty was that of being sure of getting a representative sample. They were rather between two pillars in the matter, and he did not think it was wise to use one test without the other. If they had the works test alone, they must do all the ordinary determinations of ash, volatile matter, &c., and correct sampling entered into the matter just the same as in the laboratory. He entirely favoured small-scale testing, unless the works test was carried out by the same man and under identical conditions. He would like to hear what was considered the minimum quantity of coal to be used in practical works tests—though this phrase was, after all, very vague. He had seen a plant which carbonized 100 tons of coal.

Mr. H. S. BOYES (Harrogate) said that at Harrogate they had fixed a small plant to carbonize a hundredth part of a ton, and found that the tests on it formed a good basis for comparison. With regard to sampling, there were several efficient sampling machines on the market. He fancied there was not always sufficient attention paid to the fusing properties of the ash. This was often the source of trouble in the generators. They were inclined to say that a coal with 12 p.ct. of ash must be a worse coal than one with 6 p.ct.; but, in looking at it from this point of view, they were ignoring the fusing properties. At Harrogate they had found sometimes that it paid to use the coal with the larger percentage of ash. He had in mind a test plant carbonizing 2 tons per day. This was a more or less representative sample. The results obtained on that particular test plant bore very little relationship to those on the plant in general, but were of definite comparative value. Regarding the fusing point of the ash, the behaviour of each coal was examined carefully. Each coke was watched in the producer, for fusibility, stickiness, dust, &c. The difficulty, of course, in this matter of testing, was in isolating the different coals on the works. The tests were of real value if they could be carried out.

Mr. P. M'NAB (Low Moor) agreed that a works test gave an idea of values of the coal, though the human element entered very largely into the matter. There was sometimes a larger bulk of one coal as against another. They could tell their men to mix the coals and try to get something like the result obtained by the chemist, but sometimes one came nowhere near it, and the make of gas would vary. The practical test, in conjunction with the laboratory test, was necessary.

Mr. A. H. CLUCAS said he had had no experience of the efficient samplers on the market, as mentioned by Mr. Boyes, but he had experienced the difficulties in getting a reliable sample from a truck of coal. In discussing the ash content with people, he had often been surprised at the mention of (say) 2·095 p.ct. of ash. If one was sampling a truck of coal, and got the ash to 0·5 p.ct. with normal sampling, he thought one was doing very well. It was a great mistake to quote ash figures to nearer than one decimal place, at any rate. In addition to the difficulty of obtaining ash figures due to sampling, there was the question of moisture. The latter was probably as important as the ash, and unless the samples of coal were treated in the same way before testing, the results might be misleading.

Mr. F. A. C. PYKETT (Halifax) said the subject of coal testing was rather out of his own sphere of activity in the industry; but he remembered reading in the Technical Press some time ago that one leading manager had asked, after all, what better testing plant could one have than his own ordinary plant.

Mr. CHESTER, replying to the discussion, said he had carried out practical tests of many kinds of coals, as well as laboratory determinations; and on studying the results of both had found that the latter gave the better basis for guidance, including the monetary value mentioned by one speaker. It had to be remembered that there were practically no two works operating under exactly the same conditions. One of the points he had endeavoured to bring out strongly in his paper was the desirability of the tabulation and pooling of results; but they could not compare one coal with another if tested at different works under different conditions. The laboratory test could be carried out identically at every works, and the results could then

have a monetary value put upon them. This would give the man in charge of works, who had to do the buying of coal, a guide which might help him to carry on as efficiently and as cheaply as possible. He agreed that the human element was very important. Indeed, the remainder of the work was useless if the human element in the test was at fault. A laboratory test was, in his opinion, more useful from a commercial point of view when the coal market was badly upset, as at such a time as the present. It had paid during the past year to buy coal in spot lots rather than on contract. On the offer of a spot lot, he had got a sample, and put a monetary value on it from the point of view of calorific value and coke, using his own judgment; and this had been a very important factor in buying at his place. A speaker had commented on his (Mr. Chester's) carbonizing at 900° C. This was entirely a matter of the construction of the electric furnace used, which was wound with base metal. One of higher temperature would have to be wound with platinum, which was much more expensive; and they had found the one they had gave satisfactory results. It was absolutely useless to tabulate practical works tests unless the vacuum and the seal, and all the other varying conditions, were taken into consideration; and there were so many details to look after on a practical test that it was beyond most of them to carry them all out accurately, unless they had nothing else to do. Sometimes he had carried out practical tests, but he had had a plant specially available; and, except from the coal point of view, he had not found any reliable basis to work upon. In regard to the ash content, in working on a Tully plant he had found that coal containing up to 12 p.ct. of ash was often better in actual practice than one with a 3 p.ct. ash, owing to the ash fusion. Study of the ash was certainly very important. There certainly was variation owing to moisture; but in his own case, as soon as the coal which had to be sampled was received, a note was made of its condition, and the sample was put through the test as soon as possible. Then the results were calculated to ash-free dry basis.

The meeting next proceeded to hear and discuss Mr. S. T. S. Musgrove's paper on "Maintenance," our report of which will appear next week.

ASSOCIATION OF PUBLIC LIGHTING SUPERINTENDENTS.

We understand that further advance has been made by the Executive Committee formed to bring into being the above-mentioned Association. The idea as developed since the inception at Birmingham last September is to ensure that the lighting of cities, towns, and villages throughout Great Britain shall be well done and up-to-date; and, if the latter, then it will be both effective and economical. It is this that the Association have set out to achieve. We gather that every superintendent of lighting will be eligible for full membership, and every assistant for associate membership; members of local authorities interested in public lighting being eligible as associates. Already many of the lighting engineers throughout the country have written for the purpose of enrolment. It is understood that the membership fee will be 10s. 6d., and associate members and associates 5s. per annum.

The first annual meeting will, it is hoped, be held in Glasgow in 1924, when the President (Mr. S. B. Langlands) will give an address, and a paper on the "Administration of Public Lighting" will be read. The Corporation of Glasgow have agreed to welcome the Association to the city—thus assuring a good send-off. By having the first, or inaugural, meeting in October, when the nights are dark, it is hoped to see something of the street lighting of Glasgow.

The Executive Committee for carrying out the arrangements are: Mr. S. B. Langlands (President), Glasgow Corporation; Mr. W. J. Liberty (Vice-President), London Corporation, Guildhall, E.C.; and Mr. Crane Cooper (Secretary), Wakefield Corporation. As these members of the Executive Committee are happily located, respectively, in the North, the South, and the Midlands, it should be a simple matter for would-be members and engineers to get into touch with them, when they would be most willing to answer questions, or be of other assistance.

Nitrogen in Coal.—At a meeting of the Society of Public Analysts held on Nov. 7, Mr. W. Donovan, M.Sc., read a paper on the "Determination of Nitrogen in Coal." The author confirms the work of Fieldner and Taylor, Terres, Fleischer, and others—who observed that the Dumas process as described in the report of the Research Committee of the Institution of Gas Engineers, and the Kjeldahl method, both gave results below truth, the latter by loss of gaseous nitrogen—but points out that the Dumas process makes no provision for the removal of hydrocarbons.

New Orleans and Natural Gas.—The question of natural gas has been discussed for a number of years in New Orleans, and some time ago a survey was made of the possibilities of the State in this respect. The results of the investigation show that there are only two fields from which the city might draw its supply. What is held to be the better field for the purpose is at Terrebonne; and it is thought that in time there will be sufficient development in this area to assure a plentiful supply of natural gas. The distance from the Terrebonne field to the City of New Orleans is 40 miles.

ILLUMINATING ENGINEERING SOCIETY.

THE Opening Meeting of the Society was held on Nov. 13, at the Royal Society of Arts, when reports on progress during the vacation were presented, and some interesting novelties exhibited. Mr. L. Gaster (Hon. Secretary), who took the chair, drew attention to the appointment by the Department of Scientific and Industrial Research of a Committee on Illumination, whose functions are: (*a*) To consider, and advise on, requests from other departments for investigations in connection with the lighting of buildings, and allied problems. (*b*) To co-operate with the Medical Research Council, by making arrangements for physical investigations needed in connection with physiological researches on illumination. (*c*) To examine the need for general researches on illumination. The wide terms of reference of the Committee should enable them to deal with many outstanding problems of practical importance. Mentioning the National Gas Exhibition held at Birmingham last September, Mr. Gaster said that a feature of the year has been the increased interest taken by many gas concerns in the lighting field.

PROGRESS OF THE GAS INDUSTRY.

Mr. J. G. Clark, of the Gas Light and Coke Company, gave an interesting *résumé* of the recent progress in gas lighting, as evidenced at the National Gas Exhibition. He drew attention to the great activity shown by British burner manufacturers, who had demonstrated that it was possible to produce a gas-burner which, though simple and cheap to make, was thoroughly scientific and efficient. Indeed, said Mr. Clark, it seemed that the days of the cheap and inefficient burners were numbered, and that there was every reason for believing that the gas industry could look forward to the early elimination of this impediment to the fullest development of gas lighting. Further progress in the employment of silica ware could be recorded, and he felt confident in predicting a greater future for this material. Renewed interest had also been shown in the development of gas-fittings, which were now produced in high-class style, and on a scale that meant low cost of manufacture. Standardization was also receiving attention; and this could do nothing but good for gas lighting. After dealing briefly with semi-direct lighting, and the benefits derived from the method of charging by the therm, Mr. Clark said that gas engineers were applying more and more the resources of science to their industry. A number of new and improved measuring instruments had been evolved, the object of which was always to make lighting and heating cheaper, by reducing the price of gas, and by increasing the efficiency of its application. In common with other branches of the lighting industry, the gas industry had applied itself to propaganda work, with a view to creating more public interest in the sound principles of lighting, particularly in the industrial world.

STREET LIGHTING.

Dealing with this subject, Mr. Clark said that the cluster burner was finding favour. The several methods of grouping mantles offered a variety of alternatives for meeting local conditions. The burner consumed only 16 B.Th.U. per candle-hour (lower hemispherical) as compared with a consumption of 25 B.Th.U. in the ordinary inverted burner. This advantage was due mainly to the special provision for pre-heating the air-gas mixture before it entered the flame. The reports of the Home Office Committee on Factory Lighting had been under review by all really interested in the use of gas for the illumination of industrial establishments. They recognized that, if these proposals were applied with a reasonable amount of common-sense, they could do nothing but good to all concerned. Gas engineers had been fully alive to the importance of this matter, and had spared no pains in the past to set themselves a high standard, nor would they in the future relinquish their efforts to do better. An outstanding feature of recent developments, and one worthy of mention, was the re-lighting of the reconstructed carriage-way in St. James' Park. This had been planned to form a part of the Guards' Memorial which was shortly to be erected on a site in the Park immediately opposite Whitehall. The units of this installation were of the superheated type.

Mr. Clark then mentioned the research which has been in progress at the University of Leeds, and which has recently been supplemented by the establishment of a Fellowship at the Imperial College of Science. It would be inconsistent with past experience if this new work did not provide knowledge which would help to develop still further the science of light production. There was also some promise of new developments in regard to mantles; but nothing definite could be reported. That mantle manufacturers were keenly interested in researches relevant to their product was shown by the introduction of a new testing machine, whereby the tensile strength of mantles could be scientifically studied.

DISTANT CONTROL OF LIGHTS.

Following this report, Mr. Philip H. Sugg (Chairman and Managing-Director of Messrs. William Sugg & Co., Ltd.) explained the technical points arising in connection with two important phases of recent development—the distant control of lights, and semi-indirect lighting. In his opinion, the most striking advance made in gas lighting was in connection with the distant control of lights in numbers. As they were well aware, various devices—some clockwork, others actuated by pressure-wave—for

the automatic control of gas-burners had been in existence for some time. There was also a method of control by what was known as the "mercurial seal." This system, the best example of which might be seen at Victoria Station, had been in use for a number of years, with satisfactory results. The apparatus employed consisted chiefly of a bell, floating in mercury, which was raised by the pressure of the gas. This bell automatically controlled the gas supply when the pressure fell, subsequent to the cutting-off of the supply by the control cock. The main drawback of the system lay in the fact that it was necessary to run a separate supply for the by-passes. The recent advance was in connection with the abolition of this duplicate supply. The new apparatus consisted of an annular brass casting fitted with the usual inlet and outlet ports, across which was stretched a diaphragm of flexible leather. Attached to the latter were the spindles of two valves, one of which controlled the main supply, the other the by-pass supply. These valves were so arranged that at a pressure of approximately 3-10ths to 5-10ths, the main valve remained on its seating, preventing admission of gas to the lamp. By the aid of sectional diagrams, Mr. Sugg explained the working action of this reliable appliance, and said that a controller was fitted to each lamp, but that any number of lamps could be actuated from a single main cock. It would readily be seen that, with the aid of this apparatus, the gas engineer was enabled successfully to tackle various problems which hitherto had defied solution. Among these he might mention the lighting of railway-station platforms, in connection with which it was possible to fit the distant control to alternate lights, and to extinguish every other lamp during the slack period between the arrival of trains. The system had also been applied to the lighting of large stores, public halls, and places of worship—both for internal and external lamps—and had been received with such favour by gas engineers, that in many instances companies were quoting simple-hire terms for the supply of lamps and fittings in conjunction with which the controller had been standardized.

Semi-Indirect Lighting.

One of the chief difficulties confronting the gas engineer in connection with semi-indirect lighting was the blackening of ceilings, due to the products of combustion arising from the fittings, which must be fixed relatively close to the ceiling in order to obtain the full advantage of its reflecting capabilities. To avoid this difficulty, the "Bon Marché" pendant had been designed. This, said Mr. Sugg, consisted of a lighting unit carrying the usual superheater fitted with four, six, or eight mantles, in conjunction with, and surrounding, which was fixed an enamelled steel reflector of large diameter, which served as a reflecting medium. Combustion products were not allowed to impinge on this reflecting surface, but were carried up through its centre by means of a short circular chimney, which served as a protector to the ceiling immediately above the light, and was usually of approximately 18 to 24 in. in diameter. Thus, the products, instead of ascending direct on to a relatively limited area of the ceiling, were expelled over a very wide area through the space existing between the two spinnings. Any soot which might be caused by imperfect regulation of the burners was deposited on the underside of the upper spinning, without detriment to the cleanliness of the reflector.

Lighting as a Fine Art.

There were many other features of general interest to the illuminating engineer—such, for example, as the development of the kaolin-blasted gasfilled lamp (which, by the way, is designed to obviate glare, and in consequence there is a drop in efficiency of 6 p.ct.), a display of automatic signs, a demonstration of an anti-glare motor headlight, and, finally, a brief exposition of the Irwin colour-filter system. With the advent of adequate, efficient, and controllable light, its potentiality as an artistic medium may be drawn upon; and the artist with a deep insight into the possibilities of artificial light has now his opportunity. The Irwin system is the practical outcome of an intensive study of the psychological effects of light. It consists of columnar parchment diffusers, some of which are designed purely for decorative effect, others for their properties of stimulation. The whole subject is replete with interest, but limited space debars extended treatment.

Southern Association of Gas Engineers and Managers (Western District).—There will not be a meeting of the Western District of the Association during December. Due intimation will be made of the date of the January meeting.

Midland Association of Gas Engineers and Managers.—As already announced, the autumn general meeting of the Association will be held at the Grand Hotel, Birmingham, on Thursday, Nov. 29, at 2.30, under the Presidency of Mr. P. N. Langford, of Coventry. The formal business will include a recommendation for election to honorary membership of Mr. B. W. Smith, of Walsall. Two papers are promised—one on "The Working of the 'Simplex' Water-Gas Plant in Conjunction with Horizontal Retorts on Small Works," by Mr. H. Haddock, of Atherstone, and the other on "Recent Alterations and Extensions at the Hereford Corporation Gas-Works," by Mr. Arthur Roberts, of Hereford. The meeting will also discuss a communication received from the Midland Commercial Gas Association regarding coke sales.

SCOTTISH JUNIOR GAS ASSOCIATION.

Joint Meeting of Eastern and Western Districts.

A Joint Meeting of the Eastern and Western Districts of the Association was held last Saturday week, in the new lecture hall which has been added to the equipment of the showroom section of Walls Street Station, Glasgow. Intended largely as a convenience for the juniors associated with gas manufacture and distribution in the City of Glasgow, it was fitting that the formal opening of the lecture hall should synchronize with a meeting of the Eastern and Western Districts of the Scottish Junior Gas Association. From 3 o'clock till 5, the members from both districts (who must have numbered well over 100) were shown over the various departments of the Walls Street Station. With capable guides, they made a tour in groups of ten. The whole arrangements for the visit were supervised by Mr. E. Edison Stones (Assistant General Manager to the Glasgow Corporation), Mr. Hunter (Works Manager of the Walls Street Station), and Mr. John M'Isaac (who has charge of the distributive side of the business there.

Punctually at 5 o'clock, the visitors assembled in the lecture hall. Mr. J. W. M'Lusky (the City of Glasgow's Gas Engineer) presided, and was supported by Bailie Renfrew (Convener of the Gas Committee), Mr. A. Walker, of Kilbarchan (President of the Western District), Mr. R. L. Laing, of Brechin (President of the Eastern District), and Mr. Murray (Secretary of the Western Juniors).

The Chairman said it was his duty to call upon Bailie Renfrew, as Convener of the Gas Committee, to extend a few words of welcome to the many visitors who were among them that afternoon. Speaking for himself, he was bound to say it was always an inspiration to him to appear before a meeting of Gas Juniors, inasmuch as it gave him the idea that the old enthusiasm was not passing away. He saw enthusiasm written largely on the faces of his audience. The room in which they had assembled was to form the nucleus of a scheme which he hoped would make for improvement along lines that would develop the minds of juniors. It was hoped ere long to introduce classes that would make juniors keenly interested, not only in their own departments, but in the departments of their colleagues. Just that day he had read in the "American Gas Journal" details of a scheme that had been introduced whereby men in different sections of the gas industry would meet together and discuss their separate problems. For instance, men working at invoices were not in touch with the public, neither were the men in the various works; but all were cogs in the wheel that made for progress. The Glasgow scheme was not being worked in collusion with that in the States but, singularly enough, it was proposed to develop it along similar lines. Before very long, they hoped that the lecture hall would be of great assistance to the Glasgow juniors in unravelling their many problems. Of course, the junior himself, if he was to reap the full benefit, must have a mind for study and research. He did not believe in the man who said his job finished at 5 o'clock. No gas official was worth anything at all who took that view of his work. Bailie Renfrew, who was with them that evening for the purpose of inaugurating the new lecture hall, was a practical man, who knew what it meant to serve the public. He had been serving the public in Glasgow as a master-plumber for more than thirty years, and a man with that experience could not be other than sympathetic towards the gas industry and those responsible for its maintenance and development in Glasgow. He took it that all present were essentially and primarily servants of the public, and Bailie Renfrew was a servant of the public in his business and in the performance of his civic duties.

Bailie Renfrew, who had an enthusiastic reception on rising to open the lecture hall, remarked that he had been working among gas all his life—first as an apprentice plumber, then as a journeyman, again as a foreman, and finally as a master-plumber. When he entered the Glasgow Town Council twelve years ago, he determined to see that the Corporation's gas department was completely re-organized, not only in regard to the manufacture of the illuminant and heating agent, but in relation to its distribution and supply throughout the whole city. As one of the leading master-plumbers in the city, he could bear testimony to the fact that gas manufacture had made substantial progress in Glasgow within recent years. The introduction of vertical retorts had gone a long way to build up the scheme of development. He was proud of the city, and intensely proud of the development that within a few years had been made in the manufacture and distribution of gas. It was up to the members of the Association, both in the east and the west of Scotland, to continue the good work that had been going on. In Glasgow now they had one of the largest gas-works in the United Kingdom; during the last three or four years they had expended some two-and-a-half million pounds sterling. They were now beginning to reap the benefits of this expenditure. Since their young and able Manager took over the reins of office three years ago, their progress had been remarkable. For eight years in his (Bailie Renfrew's) civic career there had been deficits in the gas department, but last year, thanks to Mr. M'Lusky and his capable assistants, they had a magnificent profit of £340,000. This notable achievement went to convince everyone that the change which had been made three years ago had been a singularly successful one. They had appointed a clever young Gas Engineer, and he had given them re-

sults. Then, while commending Mr. M'Lusky, he could not pass over Mr. Stones, his able Assistant. The gas business had been completely re-organized, and the changes that had been made were all to the good. In Glasgow they had now their own chemical department, under the supervision of Mr. Walmsley. They had stood in need of someone of Mr. Walmsley's attainments, and his appointment had been particularly successful.

Mr. A. WALKER, in calling for a vote of thanks to Bailie Renfrew and the Gas Committee, said they had been able to realize the magnitude of the gas undertaking in the city. The hall that had been provided for the city's juniors would be a distinct boon to them, and he hoped it would be taken the fullest advantage of in the future.

Mr. R. L. LAING seconded the vote, which was heartily given.

The CHAIRMAN said the hall was an investment which the Gas Committee were undertaking. He supposed he need not tell them that the dividend to the consumer would be better service. He appealed to the juniors to make the best possible use of the lecture hall, and to take the fullest advantage of the classes which in due course would be inaugurated.

Thereafter Mr. JOHN M'ISAAC delivered an illustrated lecture on "Industrial Fuel." The text of the paper was published in the "JOURNAL" for April 4 last [p. 28], when Mr. M'Isaac addressed the members of the Glasgow and West of Scotland Association of Foremen Engineers.

AMERICAN GAS ASSOCIATION CONVENTION.

Notes from the Papers and Reports.

In last week's "JOURNAL" there appeared a review of the proceedings at the fifth annual meeting of the American Gas Association, held in Atlantic City, from Oct. 14 to 18, under the Presidency of Mr. R. B. Brown, of Milwaukee. The lecture on "Experiences with the Therm in England," delivered by Dr. E. W. Smith, F.I.C., was reproduced in our issue for Oct. 24 (p. 252); and it is proposed in this and succeeding numbers to notice some of the other papers and reports submitted.

Rapid Development of the Gas Industry.

In an announcement calling the convention, the President remarked that the manufactured gas industry is now undergoing the most rapid development in its history. This, he went on, is due to the increased cost of solid fuel (which is causing thousands of manufacturing plants to turn to gas) and to higher standards of living in the American home. The present year will see approximately 400,000 new customers added to the service mains. This exceeds all previous records for advance, and calls for the financing of a $450,000,000 building and expansion programme. Rising coal prices, transportation and delivery uncertainties, and a growing desire to stop the smoke, soot, and ash nuisance at its source, are important factors responsible for the tremendous increase in sales of gas for industrial uses. To these there must also be added special rates in favour of the large consumer. In the last ten years the total production of manufactured gas has increased 100 p.ct., while during the same period the consumption of gas for industrial heating purposes has increased 1000 p.ct. Sales of gas-burning appliances for the present year will aggregate $45,000,000—a record figure. This means that for the 9,200,000 meters in use more than $4 per meter will be spent in gas company salesrooms alone, exclusive of sales made by dealers who do not report to the Association.

Organic Sulphur in Gas.

The report of the Committee on Purification, of which Dr. A. R. Powell, of the Koppers Company, is Chairman, outlined the work carried through, and concludes with two appendixes.

Organic Sulphur in Gas from Typical Plants.—The first appendix, based on data collected by Mr. J. B. Cragen, explained that, in order to gain further knowledge of the fixed sulphur content of gas at different points of the purification system, and in different types of installation, a number of tests were carried out. The information resulting had reference to water-gas plants, vertical retort plants, inclined retort plants, and coke-oven plants. The principal fact emerging from the data collected is that the organic sulphur in all the plants studied was always less (and in most instances considerably less) than the legal limit of 30 grains per 100 c.ft. Under normal operating conditions, and with the use of raw materials of normal sulphur content, it is considered doubtful whether this limit would ever be exceeded. The organic sulphur, it seems from the tests, is not decreased to any appreciable extent while the gas is passing through the condensing, scrubbing, and purifying system—with the sole notable exception that fresh oxide will absorb some organic sulphur. In boxes which are very nearly fouled, the gas has a tendency to pick up this impurity.

Removal of Organic Sulphur from Gas.—Dr. Powell contributed the second appendix, in which he explained that carbon disulphide is the only sulphur compound, other than hydrogen sulphide, which occurs in gas in comparatively large quantities, so that for all practical purposes the "organic sulphur" may be considered to be carbon disulphide. Though, he says, the organic sulphur in manufactured gas generally is well below the legal limit, in some instances this limit has been exceeded; and as coal and gas oil of higher sulphur content are used, it may be necessary for gas companies to adopt means for decreasing this constituent. With regard to carburetted water gas, one American plant using high-sulphur gas oil has been designed to deal with the organic sulphur problem by burning out at frequent intervals the carbon deposited in the carburettor. Since carbon disulphide is formed by the action of hydrogen sulphide on incandescent carbon, this procedure is regarded as a step in the right direction.

A brief but informative description of various processes for removing organic sulphur from gas is included, which will be reproduced in a later number of the "JOURNAL." The methods employed are classed as follows: (1) Hot purification, of which there are several different processes; (2) washing by oil; (3) alkalinated cellulose; and (4) charcoal or other absorbent material.

Liquid Purification.

The Purification Committee as a whole did no work upon this subject; but a paper was presented by Mr. F. W. Sperr, jun., Chief Chemist to the Koppers Company, in which was brought together information gleaned from several plants where this process has been installed. It may be recalled that at the 1921 meeting of the Association Mr. Sperr fully described the "Seaboard" liquid purification process which had been developed by the Koppers Company, and that for this paper he was awarded the Beal Medal. The process, as well as an installation at Battle Creek, was further described to the members of the Michigan Gas Association last year, by Mr. F. W. Seymour, in a paper which was reproduced *in extenso* in the "JOURNAL" for Nov. 29, 1922, p. 566. Within two years from the time when the first complete large-scale apparatus was put into operation, nearly thirty gas plants have adopted the system, in connection with gas from coke or gas ovens, horizontal retorts, vertical retorts, mixed water gas and coal gas, straight water gas, and oil gas. The plant capacities range from 2 to 30 million c.ft. per 24 hours, and the combined capacity of all the plants is 232½ million c.ft. per day.

In this process, the gas to be purified is passed into a scrubbing chamber, called the absorber, filled with suitable packing material, over which a dilute solution of sodium carbonate is sprayed. This solution takes out about 90 p.ct. of the hydrogen sulphide, and nearly all of the hydrocyanic acid. The last traces of hydrogen sulphide are removed in iron oxide catch boxes. The solution with the absorbed impurities, emerging from the absorber, passes into a second chamber, called the actifier, and is sprayed over similar packing material. Air blown into the actifier removes the absorbed impurities and regenerates the solution so that it can be used over again in the absorber. The circulation of the solution is continuous. When the development of liquid purification was first undertaken by the research organization of the Koppers Company, it was hoped to develop a process capable of removing 60 to 70 p.ct. of the hydrogen sulphide from ordinary coal gas, so as to reduce the capital, labour, and ground space required by oxide boxes. However, the process actually developed has proved readily capable of removing more than 85 p.ct. of the hydrogen sulphide, while the majority of the plants now in operation are taking out over 90 p.ct. before the catch boxes.

The paramount consideration is the amount of contact surface in the absorber and actifier. Experience has shown that, with a given apparatus, and using a 3 p.ct. soda solution, with proper actification, the efficiency of hydrogen sulphide removal increases rapidly as the rate of circulation is increased up to about 50 gallons per 1000 c.ft., but that beyond this a large increase of circulation produces only a small increase in efficiency. For a solution of any given strength, there is a certain efficient rate of circulation, above which there is little advantage to be gained. In most cases the Company provide for a circulation of 50 to 60 gallons of 3 p.ct. solution per 1000 c.ft. at the gas rate decided upon. The rate of air used for actification is approximately 2½ times the gas rate. Operating a liquid purification plant with coal gas at different rates, and assuming that there is no great variation in the hydrogen sulphide content of the gas, experience has shown that a 50 p.ct. overload can be handled at 75 p.ct. efficiency, and a 100 p.ct. overload at 60 to 65 p.ct. efficiency.

A special characteristic of the "Seaboard" process is its enormous reserve capacity with respect to hydrogen sulphide, which enables it to deal readily with gas containing amounts of this far above the normal. Both practical experience and experimental investigation indicate that the cost of treating gas containing 900 to 1000 grains of H_2S is very little more than that of treating gas containing one-third to one-half such amounts. Moreover, the process may readily be applied to gas containing still larger amounts, a very important consideration in view of the growing scarcity of low-sulphur coal. Further, in tests made at the Seaboard plant the amount of hydrocyanic acid in the gas after liquid purification has been less than 1 grain per 100 c.ft. At Battle Creek, trouble with meter deposits, which was formerly quite serious, has been completely eliminated with the advent of liquid purification. None of the plants has shown indications of any undue corrosion, and repair costs have been low. The consumption of soda in the plants is usually equivalent to about 0·125 lb. per lb. of H_2S removed. The cost of the operation of the liquid purification plant at Seaboard is 0·34c. per 1000 c.ft., and of the catch box 0·13c., making a total of 0·47c. per 1000 c.ft. The figures given by Mr. Seymour for the Battle Creek plant were 0·236c. for liquid purification and 0·15c. for catchbox operation, a total of 0·386c. per 1000 c.ft. Mr. W. S. Blauvelt has

stated the operating costs of the Terre Haute plant (exclusive of royalty and capital charges) to be 0·27c. per 1000 c.ft.

Various means are adopted, according to circumstances, in connection with the disposal of the air discharged from the actifier. The most difficult problem in the design of the apparatus has been the choice of a suitable packing for the absorber and actifier. This should be of such a character as to reduce tar accumulations to a minimum. Various forms of packing have been employed; but the present position seems in favour of the use of spiral tile or wooden hurdles. If coke is employed, the system should be kept as free as possible from tarry matter; but since practically all of the trouble with stoppages appears to occur in the absorber, there may be an advantage in using coke in the actifier and spiral tile or hurdles in the absorber. This, in fact, is being done at the Albany plant. There is considerable economy in using coke throughout in the larger plants; and in those equipped with double units the sections may be cleaned or refilled without great inconvenience, and the expense may be small in comparison with the total saving effected. Promising results have recently been obtained by the use of the Feld washer as an actifier. The tests indicate that, with this apparatus, satisfactory actification may be expected with three-quarters to one-half of the air required by the static actifier, and therefore it may prove specially useful in situations where the disposal of actifier air is a troublesome problem. Data have been obtained which show that a plant for complete purification with soda only can be designed if the need arises, though in most cases a system of liquid purification in combination with oxide catch boxes has advantages of its own.

What Makes Your Holder Go Down at Night?

The importance of the lighting load was emphasized by Mr. Jacob B. Jones, Superintendent and Treasurer of the Bridgeton (N.J.) Gas Light Company, who said that there are many towns in which a steady and sincere effort is being made to retain this business. He stated that one company alone last year sold 431,000 upright lights, 357,000 inverted lights, 167,000 upright burners, 418,000 inverted burners, 4000 "arc lamps," 2500 pendants, and 30,000 semi-indirects. All these help to make the holder go down at night. Good gas lighting helps in the sale of other appliances. He suggested that salesmen should be paid an extra commission on all lighting business obtained. While admitting that it costs more to maintain good gas lighting than it does to maintain domestic or industrial equipment, he expressed the opinion that this expense is not as great as the cost of having idle mains. If gas managers try to balance the load throughout the year, surely they should put forth every effort to balance it over the twenty-four hours.

(To be continued.)

ACID RAISING.

New Apparatus for Pumping Acids.

As manufacturers of acid-resisting metals, the experience of Messrs. Meldrums, Ltd., dates back to some years before the war. Their first manufacture consisted of simple parts, such as cascade basins, pipes, bends, &c. The remarkable acid-resisting properties of the metal led to numerous demands from the chemical trade for more intricate and difficult castings and machine parts. The extreme hardness of high-silica irons necessitated special designs when the parts had to be machined, and also special machines to deal with them. In pieces of apparatus such as pumps, cocks, and valves, the hardness of the metal is a distinct asset, for it greatly increases the life of the rubbing surfaces. In a previous design of pump, the castings were split down the centre of the volute; and this resulted in the delivery branch being divided. In the new pattern, the volute and delivery branch are made in the same casting, and a separate cover carrying the suction branch is bolted to it. Messrs. Meldrums consider this to be a distinct advantage, for it enables the whirlpool chamber and volute to be made of a more uniform shape, and at a given speed and diameter of impeller it is possible to obtain higher lifts than with previous designs.

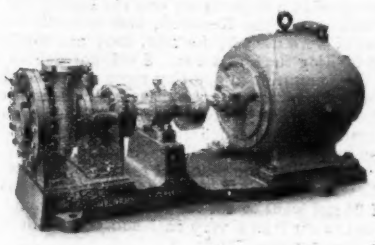


Fig. 1.—Motor-Driven Acid Pump.

The pump (shown in figs. 1 and 2) may be driven either by motor or by belt drive. The metal is proof against sulphuric, nitric, and acetic acids of any strength or temperature. In the belt-driven pumps the countershafts are provided with fast and loose pulleys and belt-shifting gear running on ball bearings. A flexible coupling connects the belt countershaft or motor, as the case may be. These pumps are manufactured in standard sizes up to 8 in. delivery and 120 ft. head.

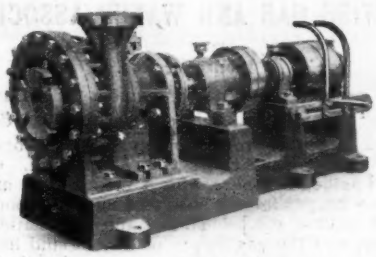


Fig. 2.—Belt-Driven Acid Pump.

Another method of raising acids is by means of the automatic compressed-air elevator. This type of apparatus, an illustration of which is reproduced (fig. 3), finds favour in acid plants, for high lifts are obtainable by a corresponding increase in the air pressure. The elevator works automatically—*i.e.*, when there is no acid running into the vessel, no air is used. As the acid rises in the container, it lifts a float which operates the air valve. As soon as the air enters the vessel, it closes the inlet valve and the air-bend valve. The vessel is now sealed, and the air pressure forces the acid out through the delivery pipe at the bottom of the reservoir. The air follows the acid up the pipe, the pressure is at once reduced, and the float drops, closing the air valve. The inlet valve again opens, and a fresh supply of acid enters the vessel. The acid can be allowed to trickle in slowly, and the apparatus works with certainty as soon as a definite level of the acid in relation to the float is reached.

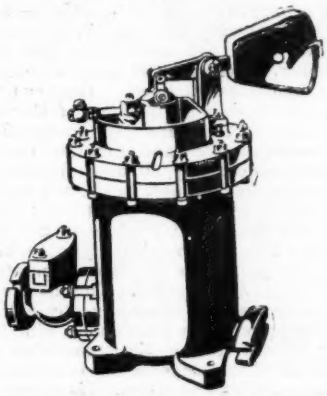


Fig. 3.—Automatic Compressed-Air Elevator.

The firm are also developing a further improvement in compressed-air elevators. In this case the acid is operated by a plunger, and the air does not come in contact with it. This type has the advantage of being economical in air. It works automatically, but requires a reservoir from which to draw, for it operates whether or not the acid is being pumped. In consequence, it should be used where there is a continuous supply of acid.

As a cheap means of raising acids, the steam-jet apparatus is useful in many cases. In this appliance the steam dilutes the acid to some extent, and this is frequently a disadvantage; in other cases it does not matter. These four types of apparatus show the extent of the development which Messrs. Meldrums have made in this direction.

The Service Charges in Gas Rates.—The Missouri Public Service Commission makes the following explanation as to why gas companies in the States make a service charge. Deciding a rate case, they said: "There are certain costs common to all users, and which are incurred whether the consumer uses gas in large quantities or no gas at all. Interest and depreciation on the investment in the meter, the inspection of the meter, and the removals and repairs to meters are all items of expense that are wholly independent of the amount of gas consumed. Interest, depreciation, and maintenance of services owned by the company are all items of expense that are incurred even though no gas is consumed. Meters must be read, charges entered on the books, bills rendered to consumers, accounts collected, stationery and supplies used, and all of the foregoing work supervised although not a cubic foot of gas is consumed. It is these costs that the service charge distributes equitably among consumers, so that each customer will pay the actual expense he causes the company, and all customers will pay the same price for gas consumed."

THE SWISS GAS AND WATER ASSOCIATION.

Jubilee Meeting.

From an account in a recent number of "Das Gas- und Wasserfach," we are able to place on record a few details of the meeting held in Zurich from Sept. 7 to 10, in celebration of the fiftieth anniversary of the Swiss Gas Association. On May 18, 1873, it was founded in Berne, with a membership of 28, representing a total output for the whole country of about 9 million cub.m. [318 million c.ft.] To-day the Association numbers 367 members, and the gas output of Switzerland has increased to 190 million cub.m. About 180 members in all attended the meeting, and foreign representatives included delegates from the French, Italian, Dutch, and German Associations, who all offered congratulations and good wishes at a formal banquet held on the last day of the congress. The President was Herr Escher, Director of the Zurich municipal gas undertaking. He was also the author of the first paper, dealing in an interesting manner with the gas supply of the city of Zurich, and the manner in which enormous difficulties with regard to pressure regulation in the mountainous districts had been overcome.

Herr Escher was followed by Dr. Schläpfer, of the Zurich Fuel Testing Institute, on "The Behaviour of Coke at High Temperatures," dealing principally with its specific heat, its chemical behaviour and its reactionary capacity. With regard to the specific heat, his own work had shown him that the findings of Terres and Schaller, as well as of Magnus, were accurate enough for ordinary technical calculations. His own investigations, however, in agreement with the findings of Debeil and Scherr, pointed to the fact that there are only two modifications of the element carbon—viz., diamond and graphite. Coal-carbon, coke, and graphite must, accordingly, all have similar specific heats. That of coke is influenced not only by the ash content, but also, to a surprising degree, by volatile constituents, and the author referred to the important part it plays in dry-quenching processes. With regard to the chemistry of coke, he pointed out that, in subsequent gasification at high temperatures, considerable quantities of gas are evolved. This hardly contains any nitrogen, but is composed of almost exactly half carbon monoxide and half hydrogen. In accordance with the researches of Bunte and Kölmel in the Karlsruhe Gas Institute, Dr. Schläpfer has extended the scope of his investigations into the capacity for reaction of various cokes. He is studying not only the ignition point and the beginning of the reaction, but also its whole course of development. Useful data are thus being collected concerning the varying reactions of coke in respect of its combustion to carbon dioxide on the one hand, and the reduction of the carbon dioxide on the other. It is his aim, when more is known of the reactionary capacities of various cokes, and means are available for measuring them, that attention should be given to the technical side of the question, and endeavour made to produce coke of special attributes for special purposes.

Prof. Dr. Ott, of the Zurich Gas-Works, read a paper on the question of waste liquors from gas-works. A fuller notice of this is promised for a later number of the German journal. Dr. Ott gave the results of actual experiments made to test the damaging effects of naphthalene, ammonia, phenols, and crude ammoniacal liquor. Naphthalene proved to be by far the most poisonous to fish. Means were referred to for dealing with these troubles.

The last paper on gas subjects was by Herr Günther, of Zurich, in which he described the gas supply of Zurich-Meilen. This is effected by means of a steel main of over 500 welded joints, which proved on completion to be absolutely gas-tight. The cost of welding was the same as for ordinary socket joints, so that a saving was effected by the smaller number of joints necessitated by the greater lengths of pipe possible with steel mains. The rotary fan used to give the pressure shows exceptional results, and the distribution takes place from three relay holders.

The entire jubilee celebration was acclaimed as a great success, and worthy of the important occasion. The membership of honour of the Association was conferred upon Herren Peter, of Zurich, Kilchmann, of St. Gallen, and Burkhard, of Lucerne, in token of eminent services to the industry and the Association. A signal honour was also conferred upon Herr Zollikofer, of St. Gallen, and, through him, upon the whole industry, by making him, in the course of the Congress, an Honorary Doctor of the Zurich Technical University.

With its technical business, visits, excursions, banquets, and dancing, the jubilee meeting will long be remembered.

Manchester and District Junior Gas Association.—There is to be a visit of the Association on Wednesday, Dec. 5, to the Boiler Works of Messrs. Galloways, Ltd., Bennett Street, Ardwick, Manchester. Tea will be provided, after which Mr. C. H. Bamber, B Sc., of Bolton, will read "Notes on Waste-Heat Boilers."

Public Works, Roads, and Transport Congress.—As already announced, the conference in connection with the congress, arranged by the Institution of Gas Engineers, takes place at 11 a.m., in the Shepherd's Room, Agricultural Hall, London, on Wednesday next, Nov. 28. Copies of the papers to be read and tickets of admission can be obtained on application to the Secretary of the Institution, No. 28, Grosvenor Gardens, S.W. 1.

CORRESPONDENCE.

[*We are not responsible for opinions expressed by Correspondents.*]

The Halifax Two-Part Gas Tariff.

SIR,—I have pleasure in replying to your question appended to my letter of the 10th inst.—see "JOURNAL," p. 457.

Your objection is that the consumer who uses 56,200 c.ft. of gas per annum is, under the two-part scheme, called upon to pay more per 1000 c.ft. for his supply than the other consumer who uses only 49,700 c.ft.

The explanation is:

1.—That the quarterly fixed charge—which is based upon the "Standard Requirement" of the premises—is greater for the larger house.

2.—That the larger householder did not make use of his larger hourly requirement for as many hours during the year as the smaller householder.

The following table shows the particulars of the three cases referred to in our circular to the consumers [*ante*, p. 271], and quoted by you in your leader, p. 373. Column 8 of this table shows that the largest householder of the three would have to consume 82,800 c.ft. of gas per annum in order to bring his average price down to the level reached by the small householder.

The feature of the scheme is that it brings the advantage of a low price within the reach of the smallest householder, and that every householder who "turns over"* the "Standard Requirement" an equal number of times per annum gets an equal advantage in price.

TABLE.

Standard Requirement Basis of Fixed Charge.	Fixed Charge. Per Week.	Fixed Charge. Per Annum.	Actual Consumption.	Price of Gas per 1000 C.Ft.	Total for Year.	Pence received per 1000 C.Ft.	Consumption of Gas required to Make the Average Price received 2s. 9·42d.
C.Ft. (1)	(2)	(3)	C.Ft. (4)	(5)	(6)	(7)	C.Ft. (8)
9,000	9d.	39s.	49,700	2s.	138s. 5d.	33·42d.	49,700
12,000	1s.	52s.	43,000	2s.	138s.	38·51d.	66,200
15,000	1s. 3d.	65s.	56,200	2s.	177s. 5d.	37·88d.	82,800

* NOTE.—The expression "turns over" perhaps requires explanation. The following example will show what is meant:

"Standard Requirement"	9,000 c.ft.
Multiplied by 5½	49,500 "
"Standard Requirement"	12,000 "
Multiplied by 5½	66,000 "
"Standard Requirement"	15,000 "
Multiplied by 5½	82,500 "

If every householder turns over his "Standard Requirement" 5½ times per annum, his average price will be roundly 2s. 9d.

W. B. M'LUSKY,
Gas Engineer and Manager.

Halifax, Nov. 17, 1923.

Institution of Gas Engineers and British Refractories Research Association.

SIR,—I have read in your last issue the published letter addressed to the Secretary of the Institution, in which my friends Col. C. W. Thomas and Dr. J. W. Mellor have made an attack on the remarks I made when presenting the Report of the Refractory Materials Committee at the Belfast Meeting of the Institution. They have handed out to me what are undoubtedly meant to look like very hard knocks. They will not mind, therefore, if what I say in reply "gets them heavily in the neck."

They do not say what erroneous impression they fear my remarks have made, and, generally, they proceed to confirm in an explanatory way the essential things I said. They have no right to say that I asked for results before results were due. After three years' work the gas industry is entitled to expect some benefit from the research.

When they compare in a disparaging way the Institution's subscription with the whole cost of the Research, and mentally visualize the commercial value of work done by its cost, they are surely dropping their guard, and inviting the knock-out. I will not deliver it. I will just say that, if the Institution are getting more than their share of the research work, which now costs £5000 per annum, definite results will have to come along faster, to justify this sum. When I say definite results, I mean results having a definite commercial value—scientific results which can become at once applied science in industry. My aim and object is to get such definite practical results from this most important research, which is vital to improved methods of working in the gas industry. I do not want to kill the research—far from it. On the other hand, I want to stir it to a very real and active life devoted to practical, rather than academic, ends.

Three years ago, when I was in the United States with Mr. W. B. Leech and other members of the Institution, we found the gas industry there was going all out for silica retorts. Now the British gas industry is beginning to travel the same road. What scientific guidance have we had from the British Refractories Research Association?

I will call particular attention to two paragraphs in the letter, and comment on them:

1. With regard to sillimanite, they say: "We hope indeed that the working of these retorts will be so satisfactory as to delay the comple-

tion of the report for a long time." Instead of gloating over delays, I want to see their aspirations turn towards progress.

If they had read my remarks dispassionately, they would have found that part of their letter, including the gibe "four months of fourteen," unnecessary.

2. They say that "the Refractories Association has not annexed the previous work" of the Refractory Materials Section of the Institution of Gas Engineers; "it merely took over and continued work which was incomplete at the express desire of the Department of Scientific and Industrial Research." I like the word "express"—it suggests speed. But what I want to record is that, besides taking over our work—which they consider quite different from annexing it—they took all our plant, instruments, and appliances at Stoke, without paying one penny for them. This they seem to forget when they try to magnify their own prestige by belittling our standing.

Mr. W. B. Leech has added to the discussion at Belfast by a written communication in which he advocates the Institution's spending more money over this most important research work. I quite agree with him about its extreme and urgent importance, but I emphasize again that we want beneficial industrial guidance as well as expenditure.

Now the bout is over, I am prepared to call it a draw; and I suggest that we determine to obtain some benefit from it by keeping our eyes fixed for future work on industrial improvements emanating from our work, realizing that without them industry and commerce have little interest in, and no use for, research.

A. E. BROADBERRY,
Chairman, Joint Committee on Refractory Materials.

28, *Grosvenor Gardens, Westminster, S.W.* 1, *Nov.* 15, 1923.

REGISTER OF PATENTS.

APPLICATIONS FOR PATENTS.

[Extracted from the "Official Journal" for Nov. 14.]

Nos. 27,694 to 28,406.

ALEXANDER, A. H.—"Apparatus for exchanging incandescent gas-mantles, &c." No. 28,308.

CUMMISKEY, J.—"Fluid-controlling cocks." No. 28,341.

DOLPHIN, J.—"Atmospheric gas-burners." Nos. 28,375-28,376.

DOLPHIN, J.—"Rotary valves for controlling flow of gas, &c." No. 28,377.

GIBSON, A.—"Production of combustible gas." No. 28,072.

GRIER, T.—"Lanterns for outdoor, &c., lamps." No. 28,334.

HOWLETT & Co., LTD.—See Dolphin, J. Nos. 28,375, 28,376, and 28,377.

LOW, L. W.—"Manufacture of emulsions or solutions of tar, &c." No. 28,065.

MILLER, C. J.—See Cummiskey, J. No. 28,341.

RITCHIE, M. C.—See Alexander, A. H. No. 28,308.

SCHNEIDER, H.—"Internal-combustion engine in combination with gas-turbine." No. 28,175.

SMITH, F.—"Inverted incandescent gas-burners." No. 28,403.

THOMSON, C. H.—See Cummiskey, J. No. 28,341.

APPLICATION FOR EXTENSION OF PATENT.

Notice is given that BERNARD ROBERT PARKINSON (the registered proprietor of patent No. 23,414 of 1907 for "Improvements relating to securing the ends of service pipes to gas or other mains") and J. STONE AND CO., LTD. (the licensees for the manufacture and sale of the invention) have applied for an order that the term of the patent may be extended for five years or such other term as the Court may think fit.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF COMMONS.

Parliament met on Tuesday of last week; and on Friday it was prorogued to Thursday, Dec. 20.

Gas Regulation Act.

Copies were presented of Drafts of Special Orders proposed to be made by the Board of Trade under the Act, on the application of the Brierley Hill District Gas Light Company, York Town and Blackwater Gas Company, and Uxbridge, Wycombe, and District Gas Company.

Disposal of Gas Profits at Keighley.—By a large majority the Keighley Town Council rejected the proposal of Alderman J. W. Midgley that £1000 from the gas profits, which had been set aside for the reserve fund, should be given to the Keighley Hospital Bazaar Fund. The Council have for many years contributed £50 to this fund; but he held that it was not sufficient as a recognition of the work done by the hospital. The seconder to the resolution did so merely to allow the discussion, but did not promise to vote for it.

Reduction at Ulverston.—The Ulverston District Council have approved a reduction in the price of gas of 3d. per 1000 c.ft. as from Jan. 1 next, bringing the charge to 3s. 11d. It had been the intention of the Gas Committee to recommend a reduction of 5d., but this was modified on information as to the probable future price of coal and the cost of labour. In addition to the present system of hiring-out cookers, the department will henceforth sell cookers, fires, and boilers on the hire-purchase system, spread over three years' payment.

LEGAL INTELLIGENCE.

VERITAS MANTLE TRADEMARK PROSECUTION.

Bayswater Tradesman Fined.

Messrs. Falk, Stadelmann, & Co. were the prosecutors at the Marylebone Police Court last Thursday in a case in which Solomon Nyman, the proprietor of the Central Bazaar, No. 70, Westbourne Grove, Bayswater, was summoned for unlawfully selling, on Nov. 3 and 5, four incandescent gas-mantles to which a forged trademark—the word "Veritas"—was falsely applied, contrary to section 2 of the Merchandise Marks Act, 1887. The Magistrate was Mr. H. W. W. WILBERFORCE.

Mr. WALTER FRAMPTON appeared for Messrs. Falk, Stadelmann, & Co., instructed by Messrs. Cardew, Smith, and Ross.

Mr. CHAS. VICTOR HILL defended, and stated at the outset that he pleaded guilty on both summonses, because, apparently, the defendant had committed a technical offence.

Mr. WALTER FRAMPTON stated that Messrs. Falk, Stadelmann, & Co. were the manufacturers, among other things, of incandescent mantles, which had a trademark known as "Veritas." The upright mantles had "Veritas" right across them, and were enclosed in cases bearing the same name; while the inverted mantles had another trademark, which was a trefoil, and were also enclosed in similar cases. The defendant was, he thought, a Russian. In consequence of a letter received from a Mrs. Andrews about some mantles she had bought at his shop, Messrs. Falk, Stadelmann, & Co. consulted their solicitors. On Oct. 3 a clerk went with a gentleman to the defendant's shop, and having purchased one or two things far removed from gas-mantles, she asked if they had any mantles. The defendant produced some, and, being asked whose they were, said: "They are 'Veritas.' We do not stock any others." The clerk observed that they did not seem to be in "Veritas" boxes. "Oh!" exclaimed the defendant, "we are short of them; we have to enclose them in boxes which are not the ordinary boxes of the Veritas people." The clerk then expressed a desire to be certain that they were "Veritas"; and at her request the defendant wrote the word "Veritas" across the face of the boxes. On Oct. 5 another lady clerk called on a similar errand. She was served by an assistant; and exactly the same thing happened—"Veritas" mantles were asked for, the assurance was given that they were "Veritas," and the name was written on the box. The defendant was afterwards seen by a representative of the Company, and the present proceedings were instituted. Counsel said he could not see where the "technical offence" came in.

Mr. C. V. HILL, for the defence, having mentioned that Mr. Nyman had traded in Bayswater for ten years without any previous complaint of the kind being made against him, said there were apparently two kinds of "Veritas" mantles—Veritas Firsts and Veritas Seconds. The former were retailed at 8½d., and the latter at 7½d. The better one, he was instructed, was sold in a box plainly stamped, so that there could be no mistake as to whose make it was; while the others, "Veritas Seconds," which were the mantles sold here, were sold in plain cardboard boxes of various colours. The same observations applied to the long mantles.

Mr. WALTER FRAMPTON declared that there was no such thing as "Veritas Seconds."

Whether it was so or not, replied Mr. HILL, Counsel might accept it from him that these were "Veritas," and were of less price than the "Firsts." It was in consequence of this that the mistake arose. These particular mantles were part of a consignment which the defendant got from Rye Lane, Peckham, and they were distinctly described as "Veritas Seconds" on the invoice. He naturally assumed, therefore, that he was selling "Veritas" mantles; and on request of the purchasers he wrote "Veritas" on the boxes, because, so far as he knew, they were such.

Mr. WALTER FRAMPTON said his clients would like to know the name of the firm who supplied the mantles, as they would like to take proceedings on that invoice at once. Counsel repeated that his clients did not sell "Veritas Seconds;" but they did sell throw-outs, the trade mark on which was always obliterated. The mantles bought from the defendant, however, bore no such mark, and were not of Messrs. Falk, Stadelmann, & Co.'s manufacture.

The MAGISTRATE: You have no idea to what extent this has been done?

COUNSEL replied in the negative, but said there was a large trade in these things.

The MAGISTRATE: What is the price at which you sell the throw-outs?

Mr. *Powell* replied about 24s. to 30s. per gross, or 2s. per dozen.

COUNSEL added that "Veritas" mantles were sold at about 4s. 6d. per dozen; and the price paid in this instance was 7½d. each.

Mr. HILL said the invoice price was £2 14s.; and he thought the defendant paid 3s. per dozen.

Mr. WILBERFORCE imposed a fine of £5, with five guineas costs, on each of the summonses—£20 10s. in all.

Barnsley Low-Temperature Plant.—Additions which are to be made to their coalite plant at Barnsley by Low Temperature Carbonization, Ltd., will, it is stated, convert it into a unit of 500 tons of coal per 24 hours capacity. This, it is further said, will yield 350 tons of coalite, 1500 gallons of motor spirit, 9000 gallons of fuel oil, 3 tons of sulphate of ammonia, and a considerable surplus of rich gas. The cost of the plant has been considerably reduced.

Tutbury Council and the Therm.—The Gas Committee of the Tutbury Council have decided to forward objections to the Board of Trade, and also to the Burton Corporation, on the ground that they have no knowledge as to the standard of quality of gas which the Burton Corporation intended to supply. They point out that the district is already paying 1s. per 1000 c.ft. more than Burton, and the handicap will be greater under the therm system.

MISCELLANEOUS NEWS.

GAS LIGHT AND COKE COMPANY'S STANDARD PRICE.

London County Council Application for Revision.

The first of the applications of the London County Council to the Board of Trade for revisions of the standard prices of gas in the case of the London Companies was heard by Mr. H. C. Honey (Director of Gas Administration) on Wednesday last. This application was in respect of the Gas Light and Coke Company, and the inquiry was held at the Institution of Civil Engineers, Great George Street, Westminster.

After the excitement associated with the therm inquiry—with which the question of standard price is intimately bound up—the inquiry on Nov. 14, which is really of much greater importance to the general public, was a dull affair. The large lecture theatre was but sparsely occupied; and there was no great array of the legal profession in the shape of K.C.'s. Each side confined evidence to one witness, and the whole business was got through between the hours of 11 a.m. and 4 p.m. Moreover, the actual difference of opinion, as to the present-day cost of the production and sale of gas, between the London County Council advisers and the Company amounted only to decimals; but an important principle is at stake which both sides were willing to leave to the decision of the Board of Trade. In short, it is that the Gas Light and Coke Company contend that any reduction in the cost of production due to improved methods—in other words, any improvement brought about by means within the control of the Company—should not be taken into account in fixing the new standard price. Anything due to the fall in prices of materials or cost of labour, it is agreed, should be taken into consideration; and on this basis the Company welcomed the application for a reduction of their standard price, regarding a too high standard price as an embarrassment rather than otherwise. There is thus a matter of principle involved, which is of great importance to all gas companies.

The London County Council were represented by Mr. Rowand Harker; and the Gas Light and Coke Company appeared through Mr. Jacques Abady. As will be seen by our report, Mr. W. R. Herring, who has been advising the Ilford Urban District Council in the matter, appeared in their behalf in the absence of the Town Clerk.

Mr. Rowand Harker, stating the case for the London County Council, said the application was being made under section 1 of the Gas Regulation Act, 1920. The Council appeared upon this application in the statutory capacity of a local authority. For most purposes, the London County Council were not a local authority in the ordinary sense, but there was a special provision under section 18 of the Act of 1920 which enabled them to make such an application as this to the Board of Trade. So far as the Gas Light and Coke Company were concerned, it would be sufficient for him to say that they supplied gas over a very large area, a considerable portion of which was in the Administrative County of London. The area also included the City of London, the Borough of Acton, a portion of the Borough of West Ham, and also the urban districts of Leyton, Ilford, Willesden, and other districts. He understood that, with regard to some of these other districts outside the Administrative County of London, representations had been made to the Board of Trade by the local authorities concerned, in support of the application of the London County Council; and in the case of one or two of them, he understood, they would be represented. Counsel then went on to explain that the Gas Light and Coke Company were a sliding-scale company; the slide being fixed by the Company's Act of 1909. As a matter of fact, the Company had been operating under the sliding-scale for some considerable time before then; the Act of 1909 being in the nature of a consolidating Act at the time the West Ham Gas Company were absorbed. Under section 34 of the Company's Act of 1909, the slide operated in this way. For every penny or part of a penny which the Company charged above the standard price, they were compelled to reduce the dividend by 2s. 8d. p.ct., and for every penny charged for gas below the standard price, the Company were allowed to increase their standard dividend by 2s. 8d. p.ct. In the case of the Gas Light and Coke Company, the slide worked well before the war, being on the 1000 c.ft. basis. The standard price then was 3s. 2d. per 1000 c.ft., with a standard dividend of 4 p.ct.; and the slide remained in operation until the Company got a Therm Order in 1921. As showing the satisfactory manner in which the standard price and the sliding-scale operated before the war, Counsel took the year 1913, when, he said, the price of gas was 2s. 6d. per 1000 c.ft., as against the standard price of 3s. 2d. per 1000 c.ft., and the dividend paid was £5 1s. 4d. Included in this dividend was the sum of 4s. which the Company were compelled to use for the purpose of their redemption fund.

The Position After the War.

That was the position in 1913; and then came the war. It was undoubtedly recognized by Parliament that a sliding-scale based upon a standard price and a standard dividend fixed upon the basis of pre-war conditions operated unfairly not only to the Gas Light and Coke Company, but to all the other companies working under the sliding-scale. As a result—after some companies had made individual applications for some modification—the Gas Regulation Act of 1920 was passed, which enabled gas companies to apply to the Board of Trade for an alteration of their maximum price, in order to meet the increases of cost, if any, due to circumstances beyond the control of, or which could not reasonably have been avoided by, the undertakers. This was contained in section 1 of the Gas Regulation Act, and it was under this section the Company applied to the Board of Trade in 1920 for an Order amending the standard price, which Order was granted in 1921. In their application for this Order the Company asked for three things. First, that the method of charging should be altered from the 1000 c.ft. basis to the therm basis. There had, said Counsel, already been a prolonged inquiry as to the respective virtues of the therm and the 1000 c.ft., and he did not propose to enter into this matter. The second thing asked for was a standard price of 15·6d. per therm, but the Board of Trade allowed 15·2d. in substitution of the previous figure of 3s. 2d. per 1000 c.ft.; and, thirdly, the Board of Trade, in the Therm Order, abolished the old slide of 1d. per 1000 c.ft. and substituted 0·2d. per therm. For the purpose of that conversion, gas of a calorific value of 500 B.Th.U. was taken, and he was instructed that the case was put forward by those representing the consumers on that occasion that a gas of 541 B.Th.U. should have been taken for the purpose of conversion, which was the calorific value of the gas which had been supplied by the Company for some time past. It was not his intention, however, to re-open this point; and the decision of the Board of Trade was accepted, as it was bound to be. On the basis of 500 B.Th.U., therefore, the comparison between the pre-war standard price and the new standard price was 7·6d. per therm in 1913—as the equivalent of 3s. 2d. per 1000 c.ft.—and 15·2d. per therm, as allowed under the Therm Order of 1921. In other words, the new standard price was more than twice the pre-war standard price. The important point to bear in mind, continued Mr. Harker, was that, when the Order of 1921 was granted, it was based upon figures of cost at a time when prices were nearly, if not absolutely, at the highest they had been as a result of the war. Further, the difficulties through which the country was then passing made it even more difficult than usual to form any accurate estimate as to what would be the costs of production and supply in the future. Bearing these points in mind, the case which the London County Council put before the Board of Trade now was that, since the Gas Light and Coke Company's Therm Order of 1921, there had been a very substantial drop in the costs of manufacture, with the result that the present standard price of 15·2d. per therm, arrived at in the circumstances he had mentioned, placed the Company in an unduly favourable position to-day, which, if it was continued, would result in the consumer's losing the benefit which Parliament intended he should have through the operation of the sliding-scale. In other words, the Company would be able to pay high dividends, without paying due regard to the costs of production, and to the economical administration of the undertaking, which it was intended they should, through the operation of the sliding-scale. That this was a fair statement of the position, he believed was shown by the fact that the Company paid a dividend in 1922 of £5 9s. 4d., which included 5s. 4d. in respect of the redemption fund.

The present selling price of gas was 8·6d. per therm, or 6·6d. below the standard price, and with the slide of 0·2d. per therm, it meant 33 moves of the slide. This showed what handsome dividends the Company would be able to pay. He really thought the Company themselves recognized that there must at any rate be some alteration in the present standard price, because the Governor of the Company, at the annual meeting this year, made the following statement: "No doubt some shareholders may have expected the distribution of a higher dividend, as the present standard price would have permitted of the payment of a dividend of £6 10s. 8d. p.ct. It should be remembered, however, that this latter figure is in accordance with the price of gas fixed in March, 1921, when circumstances were altogether different." Therefore, Mr. Milne Watson was evidently endeavouring to placate his shareholders and to prepare them for this application, because he went on to say: "The Directors feel it would not be in the best interests of the shareholders themselves if they were to pay dividends at a rate which might prove to be excessive." Mr. Harker said that the inference he drew from this—and he hoped the Company would regard it as fair one—was that the Company appreciated that the time had come when the standard price fixed in March, 1921, should be altered. Probably the real point which the Board of Trade would have to consider in connection with this matter was one of quantum—by how much the present standard price should be reduced. It was in these circumstances that an Order was asked for under the proviso to sub-section 3 of section 1 of the Gas Regulation Act of 1920, which enabled the Board of Trade, if it were shown to their satisfaction that the cost and charges of, and incidental to, the production and supply of gas had substantially altered, due to circumstances beyond the control of, or which could not reasonably have been avoided by, the undertakers, to make an Order revising the powers of charging authorized by the original Order. Paraphrasing this section, it seemed that the function of the Board of Trade was to endeavour to find out by how much the costs and charges of, and incidental to, the production and supply of gas had been reduced by reason of the matters referred to in the proviso mentioned above.

To indicate the principles which the London County Council had adopted in order to endeavour to comply with the provisions of section 1 of the Act of 1920, Mr. Harker said it was appreciated that the burden was, at any rate in the first instance, on the London County Council. It was also appreciated that the burden was not an easy one to discharge, because all the Council could have access to were the published accounts of the Company. Indeed, all the material which the Council had had for the purpose of this application was the information contained in the accounts of the Company for 1921 and 1922. Information as to the working during the present year was not obtainable, although perhaps the Company would furnish it during the inquiry. Therefore, the main object of the evidence which would be given on behalf of the Council, would be to find out what was the cost of the production and supply of gas at the present time; and the method which Mr. Valon, the London County Council's expert adviser, and Mr. Johnson, the Controller, had adopted was to work on the figures for 1922, and make such adjustments as seemed fair and reasonable. For instance, regarding wages, evidence that compared with 1922 would be given. There had been an over-all reduction in salaries and wages of 10 p.ct., and this reduction had been made in the figure for this item in 1922. That was merely an instance of the method which had been adopted. Take again the important item of repairs and maintenance. It was the view of the advisers of the Council that 1922 would not be a fair year to adopt as a basis upon which to arrive at a proper estimate of the present-day costs of repairs and maintenance; the reason being that the Gas Light and Coke Company, with most other companies, were, for some two or three years after the war, making up arrears of repairs, the expenditure upon which appeared in the 1922 accounts. Therefore, in regard

to this item, and some others of a similar nature, the method adopted had been to take the pre-war figure per 1000 c.ft., and to add to this cost what was believed to be an accurate percentage representing the difference between (say) repairs and maintenance to-day and in 1914. This seemed to him to be the only possible method which could be adopted, in view of the fact that the London County Council had no means of obtaining any information except such as was to be found in the published accounts. The whole of Mr. Valon's calculations

TABLE I.—*Estimate of Present Cost of Supply by the Gas Light and Coke Company.*

	£	£	Pence per 1000 C.Ft.
1. Coal, 1,897,635 tons at 29s.		2,751,571	20·44
Residuals—			
2. Coke, 1,010,225 tons at 29s.	1,464,826		
3. Breeze (as in 1922)	105,202		
4. Tar, 17,658,782 gallons at 6d.	441,470		
5. Liquor, 495,110 butts at 6s.	148,533		
7. (Equals 78·5 p.c. of cost of coal)		2,160,031	16·04
8. Net coal		591,540	4·40
Adjust to allow for a return for residuals of 72 p.c. of cost of coal, instead of 78·5 p.c., equal to 14·72d.—a difference of			1 32
			5·72
9. Oil for water-gas manufacture, 11,613,240 gallons at 3·6d.		174,199	1·29
10. Coke and breeze—			
Coke, 209,614 tons at 29s. 6d.	309,180		
Breeze, 54,142 tons at 10s.	27,071		
		336,251	2·50
12. Salaries and wages—	d.		
1922	3·44		
Less reduction of 10 p.c. under 1922 average	0·34		
			3·10
13. Purification (as in 1922)			·45
14. Repairs and maintenance of works and plant—			
Allow 1·8 times pre-war	4·43		7·97
15. Salaries and wages—			
1922	2·35		
Less reduction of 10 p.c.	·23		
			2·12
	Pre-War. d.		
16. Repairs, &c., of mains and services	1·75		
17. Repairs, &c., of meters	·73		
20. Repairs, &c., of stoves	1·42		
23. Automatic installations	·37		
	4·27		
		d.	
Allow 1·8 times 4·27d.		7·69	
Depreciation (as in pre-war)—			
Meters		·69	
Stoves		·37	
		8·75	
Less rentals (as in 1922)—			
Meters	1·34		
Stoves	1·63		
Automatic installations	2·29		
		5·26	
			3·49
26. Rents, rates, and taxes—			
1922	4·31		
Less reduction of 20 p.c.	·86		
	3·45		
Less rents received	·19		
			3·26
29. Salaries of office staff and collectors—			
1922	1·40		
Less 10 p.c. reduction	·14		
		1·26	
30. Directors' allowance (1922)		·06	
31. Other charges—			
Allow twice pre-war (0·22d.)		·44	
		1·76	
Less transfer fees		·01	
			1·75
Miscellaneous expenses—			
32. Superannuation	·88		
33. Co-partnership	·43		
34. War bonus and war fund	..		
35. Leasehold renewal fund	·01		
	1·32		
36. Other charges 0·90			
Less Ilford amalgamation expenses 0·37			
	·53		
			1·85
37. Total net expenditure on revenue account			33·50
38. Interest on temporary loans			*Nil*
Interest on consumers' deposits, £49,092 at 5s. = £2455			0·02
41. Interest on debentures (as in 1922)			1·16
43. Total expenditure, including interest			34·68

would be placed before the Director in the form of two tables; and from these it would be seen that the Council, as representing the consumers, put forward that a reasonable standard price in present circumstances in the case of the Gas Light and Coke Company would be 10·76d. per therm; or, taking the nearest round figure, 10·8d. per therm. Having regard to the present selling price of gas—viz., 8 6d. per therm—a standard price of 10·8d. per therm would enable the Company, with due economies in management and administration, to pay dividends certainly not less than (his own working-out of the figures showed they would be greater than) the dividends which were being paid immediately before the war.

Mr. *Arthur Valon* then gave evidence, and said he had first of all examined the accounts of the Company, and also the estimated figures which the Company placed before the Board of Trade when they made their application for a Therm Order in 1920. He first made a preliminary estimate, and subsequently prepared the one shown in Table I., with the help of certain information, relating to the price of coal and the revenue from residuals, which the Company had been good enough to give him.

METHOD OF CALCULATION.

After pointing out, as mentioned by Counsel, the precise method which had been adopted in arriving at these figures, witness dealt with the items in detail. As regards coal, the quantity taken was the amount carbonized in 1922, and the price of 29s. was obtained from the Company as the average per ton at present, and taking into account what was estimated would be the cost to the end of the year. Against the figure of 20·44d. per 1000 c.ft. so obtained, had to be be set the receipts from residuals; and he had dealt with these in exactly the same manner as the coal. In this way the net cost of coal was 4·4d., but he thought it fair to make an adjustment of this figure by way of an increase in the net cost; this adjustment bringing the net cost of coal up to 5·72d. per 1000 c.ft. His reasons for making this alteration were that, on the figures he had previously worked out, the receipts from residuals were 78·5 p.c. of the cost of coal; but this was considerably higher than the figure for the previous two years, when it was 60 p.ct. Before the war, the return was very much higher—about 81 p.ct.—but the Company put in an estimate of 74 p.ct. when making their application for the Therm Order in 1920. It was well known that the Company had made some very favourable coal contracts just before the increase in prices this year, and therefore they got their coal at a very much lower price than if they had not bought so early. The price of residuals would be affected to some extent by the higher price of coal; and it was for this reason he had made the adjustment referred to. He had assumed that it might reasonably be expected that, had the Company had to pay another 2s. 6d. per ton for coal, the return from residuals would have been 72 p.ct. instead of 78·5 p.ct.; and he had therefore adopted the lower figure. So far as the price of coal was concerned, he did not like to prophesy about the future, but it seemed to him there was just as much probability of the Company's getting coal at 29s. per ton in the future as of having to pay a higher price. Even with coal at 29s., he did not think it would be fair to take the return from residuals as higher than 72 p.ct. In the case of the coke and breeze used in the manufacture of water gas (item 10) he had taken 29s.—the net price received for coke—and added 6d. per ton for labour. Again, as regards salaries and wages (item 12) he had taken the 1922 figures, and adopted an all-round reduction of 10 p.ct., though in the case of the labourers it was about 12 p.ct. In the case of stokers the reduction had been less than 10 p.ct. Dealing with repairs and maintenance of works and plant (item 14) witness said he believed the present cost was about 80 p.ct. over pre-war; but, in this case, instead of taking the 1922 figures—as with salaries and wages—he had taken the 1914 figures, and applied a multiplier of 1·8, because there had been no normal figures for repairs and maintenance since the war. Passing over the succeeding items, which have been dealt with on exactly the same basis as in 1922, Mr. Valon mentioned that all the figures for repairs and maintenance excluded depreciation; and he had taken this as pre-war. As regards item 26 (rents, rates, and taxes) he had taken the 1922 figures, and had made a reduction to the extent of the average reduction in the rates in the £ between 1922 and the present time, on the basis of information received from the London County Council Valuer. The reduction of 20 p.ct. shown on the Table should not be applicable to rents, though he did not suppose the amount would be sufficient to make any material difference. In connection with office salaries (item 29) he had adopted the 10 p.ct. reduction, as in the previous case. With Directors' allowance (item 30) he did not propose to interfere. Having enumerated the other items shown on the Table, witness explained that he had arrived at a total figure of 34 68d. as the present total expenditure per 1000 c.ft. on the production and distribution of gas by the Gas Light and Coke Company.

Using these figures in Table I., he had arrived at the estimate of a new standard price, as shown in Table II.

TABLE II.—*Estimate of New Standard Price.*

		Pence per Therm.
Present cost of supply—		
34·68d. per 1000 c.ft. at 492 B.Th.U.		7·05
Pre-war cost of supply—		
21·02d. per 1000 c.ft. at 541 B.Th.U.		3·89
Increase in cost over pre-war		3·16
Standard price—	d.	
Fixed by Board of Trade in 1921	15·20	
Pre-war standard price, 3s. 2d. per 1000 c.ft., converted at 500 B.Th.U.	7·60	
Increase in cost of supply under Gas Regulation Act, as found by Board of Trade		7·60
Fall in cost of supply		4·44
Standard price fixed by Board of Trade in 1921		15 20
New standard price		10·76

Witness briefly explained this table, and said that 492 B.Th.U. was the average calorific value of the Company's gas in 1922, whereas

the pre-war quality was 541 B.Th.U. Deducting the fall in the cost of supply, as shown by his figures of 4·4d per therm, from the previous standard price of 15·2d. per therm fixed by the Board of Trade, a new standard price of 10·76d. per therm was obtained.

CROSS-EXAMINATION OF MR. VALON.

Mr. ABADY (cross-examining for the Company) put it to witness that the improvements arising from causes within the control of the Directors, such as improved methods of operation, ought not to be taken into consideration under the Gas Regulation Act, for the purpose of considering a reduced standard price.

Mr. HARKER objected that this was a matter of the construction of the Act of Parliament, and not a question for a gas engineer to answer.

Mr. HONEY said he saw no objection to Mr. Valon answering.

Witness said he did not think Mr. Abady's point necessarily followed from the Act. It did not say that fluctuations in cost under the control of the Directors should not be taken into account.

Mr. ABADY then put it that the figures which Mr. Valon had arrived at purported to be the cost of producing and supplying gas at the present time, but they did not coincide with the estimate the Directors had prepared of the cost during the present year. For instance, Mr. Valon had not taken into consideration any improvement in manufacturing methods.

Witness replied that he did not think any improvement in manufacturing methods in a concern of the magnitude of the Gas Light and Coke Company would appreciably affect the figures of the past two or three years.

Mr. ABADY, in the course of further questions, said he would state that, though the estimate put in by Mr. Valon differed but slightly from that which the Company had prepared, where there was a difference it was important. Mr. Valon's figures were based upon a series of hypotheses which had no relation to the actual working at the present time. For instance, the calorific value taken by Mr. Valon was wrong, as were the price of coal and returns from residuals.

Witness said he had worked on the figures supplied by the Company. They were presumably, therefore, correct. Whether they had been properly or improperly used, was another matter. The figures themselves, however, he took it were correct. If they were wrong, they were wrong because they had been given wrongly by the Company.

Mr. ABADY added that the quantity of gas sold, taken in the estimate, was not the right figure at the present time.

Witness said he could only take the figures given him by the Company. So far as the calorific value was concerned, if this had changed, it would have changed in favour of the Company, and not of his estimate. He had obtained his figures by taking the gas sold in 1922, and did not imagine that the cost per 1000 c.ft. would differ materially in 1923.

Mr. ABADY said his difficulty in dealing with Mr. Valon's estimate was this: Mr. Valon had taken coal at a certain price, which he had been given to understand was the present price. The question was whether this was going to be the price next year. The same with coke. Mr. Valon had taken certain prices per ton, but had altered the price by the percentage alteration he had made in the proportion of residuals to coal. The figures which Mr. Milne Watson would put in would show a higher net cost of coal, while a lot of the remaining items in Mr. Valon's estimate were hypothetical figures. The Company had better information than Mr. Valon.

Witness said the Company might not use so much oil for water gas, because they were not making such a large proportion of water gas, and this would affect the other figures—coal and residuals. It was, of course, only the people who knew the proportions of coal gas and water gas being made who were capable of preparing an accurate estimate; but it would not make any difference in the total cost. As to the amount in money represented by his figure of 7·97d. per 1000 c.ft. for repairs and maintenance of plant, this worked out to £1,073.113; but the thing which was of importance was the cost per 1000 c.ft., and not the total amount of money.

Mr. ABADY also indicated small differences in certain other respects between Mr. Valon's estimate and that which had been prepared by the Company, and contended it was not right that the whole of the saving suggested by Mr. Valon as between the 1921 standard and the present time should be taken off the present standard price.

Witness remarked that, if the working in 1922 was compared with the working just before the war, there did not appear to have been any very great improvement.

Mr. ABADY: You agree that, if any improvement can be proved, it should be a factor to be taken into consideration in determining whether you should take the whole of the 4·44d. off the standard price?

Witness: I think that is a matter for legal argument.

Mr. ABADY suggested that it would make very little difference to the consumer whether the whole of the saving was taken into account, or whether that portion due to circumstances within the control of the Directors was left out of account.

Witness replied that it would make very little difference to anybody, because practically the whole of any reduction in cost during the last two or three years must have been due to matters outside the control of the Directors.

Mr. ABADY put it that, supposing there had been a saving in cost of £150,000 due to causes beyond the control of the Directors, the consumers would get the benefit of all of it. On the other hand, if the saving were made through causes within the control of the Directors, then, on the case he was putting forward, the consumer would get £130,000, and the shareholders £20,000.

Witness agreed that this would probably be the figure.

In re-examination, Mr. HARKER laid stress on the admission by Mr. Abady that there were only small differences between the estimate prepared by the Company and the one put in by Mr. Valon. The main point, therefore, was as to whether any proportion of the saving that had been made since the Therm Order of 1921 was due to causes in the control of the Directors, and what proportion of the reduction should be taken out of the account in considering the standard price. Before anybody was in a position to say that improvements had taken place in working, it was necessary to inspect the works.

Witness agreed, and added that an application by him to the Company to be allowed to inspect the works had been refused. For that reason, he was not in a position to say anything on the points concerning this matter raised by Mr. Abady.

This closed the case for the London County Council.

ARGUMENTS FOR ILFORD.

Mr. W. R. HERRING, Consulting Gas Engineer, said that, in the absence of the Town Clerk of Ilford, he had been asked to deal with the representations of that Council. While adopting, in the main, the case of the London County Council, there were one or two points he wished to bring forward. In the first place, though supporting the figures put in by Mr. Valon, it was felt by his Council that too great an allowance had been made for depreciation. He suggested that depreciation should not be allowed to the extent that it was in 1922; and this would vitally affect the figures upon which Mr. Valon had worked. Then an important point arose out of certain replies by the Company to the representations of the Ilford Council. The Company had stated in one of these replies that they claimed some advantage from the saving in costs and charges attributable to the Company's own efforts resulting from the adoption of improved methods and from efficiency and economy in the administration and management. The reply of the Ilford Council to this was: "The Council have no desire to withdraw from the Company the full benefits and advantages due to them under the provisions of the sliding-scale as to standard price and dividend, and which are embodied in any new standard price enacted under the Gas Regulation Act by translating the pre-war standard into a rate per therm. If, however, the Company contend that they are entitled to some increase on the pre-war standard simply because they have recently lived up to the spirit of the basis of the sliding-scale provisions, by exercising due care and economy in the management of their undertaking, then the Council must strongly oppose any such claims as being contrary to the provisions of the Act." The point was this: As far as his experience went, the Board of Trade had always held that they had no right, under the Act of 1920, to interfere in any way with the pre-war standard price; that their duty was simply to translate this, and find its equivalent in a price per therm, and then add to this any increased costs due to circumstances arising out of the war. If this assumption were correct, the view of the Ilford Council was that the improvements to which the Company had been referring were already covered by the pre-war standard price. The whole basis of the sliding-scale provisions was that a company should improve their working results, and share the increased profits between the consumer and the shareholder. Therefore he held that, if the Company claimed—as appeared to be the case from the remarks of Mr. Abady—that they were entitled to something more than that which they got under the old sliding-scale, the Ilford Council would strongly oppose, on the grounds that it was an absolute injustice to the gas consumer.

Mr. HERRING then offered to go into the witness chair, and be cross-examined.

Mr. ABADY, however, said he did not desire to ask any questions, because he thought he could satisfy the Director with regard to the questions Mr. Herring had raised.

THE COMPANY'S CASE.

Mr. JACQUES ABADY, addressing the Director on behalf of the Company, before calling on Mr. Milne Watson, said that, as this was the first inquiry of its kind under the Act of 1920, he would like to make one or two observations on the general procedure. In the first place, the Board of Trade had made regulations under the Act governing applications for amending Orders, and one rule provided that an application should be accompanied by a statement in duplicate showing, by reference to the published accounts of the undertakers, the alteration in the costs of supply of gas by the undertakers upon which the application was founded. While he did not wish to raise any formal objection, he would like to point out that this rule did not appear to have been complied with by the London County Council. It might be that it was not possible for them to do so. Then as to the inquiries following an application for an amending Order, sub-section 6 of section 1 of the Gas Regulation Act laid it down that the Board should give public notice, in such form as the Board might consider best adapted for informing persons affected, of the application for, or the proposal to make, an Order, and of the maximum or standard price per therm proposed. That provision of the Act of 1920 did not appear to have been complied with by the Board of Trade. Here, again, it might be that the inquiry was one which did not adapt itself to the rules of the Board of Trade, and on behalf of the Company he waived any question of objection on this account.

Mr. HONEY said there was nothing in the sub-section of the Act mentioned which related to a public notice before the inquiry.

Mr. ABADY agreed that the sub-section read: "Before making any Order . . .," and perhaps it could be read in the manner suggested; but the sub-section later said that the public notice should indicate "the manner in which, and the time within which, objections may be made" to any Order granted by the Board of Trade, and that the Board "shall consider any objection which may be duly made, and shall, where they think it expedient to do so, cause an inquiry to be held."

Mr. HONEY said it might be that the Board would still have to give that notice after any Order was made. It was a point which would be carefully considered.

Mr. ABADY did not wish it to be thought he was cavilling, but it was quite clear that, in order to arrive at what had to be done under sub-section 3 of section 1, there had to be a good deal of give and take between local authorities and gas undertakers. The real inquiry was as to what alteration there had been in the costs and charges of, and incidental to, the production and supply of gas "from circumstances beyond the control of, or which could not reasonably have been avoided by, the undertakers;" and it was only in respect of any alteration due to those causes that the Board of Trade had power to make any revision, because the last words of the sub-section said the Board should "make an amending Order correspondingly revising the powers of charging authorized by the original Order." Therefore he contended that the measure of the reduction which the Board of Trade

were empowered to make was not necessarily to be found by a mere comparison of present-day actual or estimated costs and the costs for any previous period. Some part of the reduction in cost might be due to circumstances within the control of the Directors, such as improved processes of manufacture; and his case was that such portion of the reduced costs could not be taken into account by the Board of Trade in fixing a lower standard price. So far as the actual figures were concerned, Mr. Milne Watson would show that the present-day actual cost per therm was 7·33d., against Mr. Valon's 7·05d.; and 7·33d. per therm would entitle the Company to a standard price of 11·04d. per therm by the familiar method of calculation adopted by Mr. Valon. The Company, however, would show that, but for economies effected under the control of the Directors, the present costs would be 7 66d. per therm, or an increase over the pre-war figure of 3·77d. per therm, compared with Mr. Valon's figure of 3·16d.; or, to put it in another way, the decrease in costs since the date of the Therm Order in 1921 was 3 83d. per therm, compared with Mr. Valon's figure of 4·44d. There was therefore not a great deal of difference between the figures; but there was an important principle involved. He then gave one or two examples of the type of improvement under the control of the Directors which could result in a reduced cost of production—such as the adoption of improved processes of manufacture or an intensive advertising scheme which improved the sales out of all proportion to a normal increase due to a growth of population. If the reduction in the cost per 1000 c.ft. were taken as the measure of the reduction of the standard price without regard to these factors, then the Board would not be adopting the true measure of the reduction which ought to be made.

Counsel said he wished to make it clear that the Company admitted that a revision was due. They never had concealed this fact, because a standard price which was out of all relationship to present-day costs was a much greater embarrassment to the Company than to the consumers. The thing which determined the charge for gas was not the standard price, but the cost of production. At the same time, as he had indicated to Mr. Valon, in existing circumstances the consumer was affected little if at all. Nevertheless, the Company welcomed any reduction which was a true measure of the reduced cost—viz., in regard to changes brought about by circumstances not within the control of the Company. As to his questions to Mr. Valon, and the suggestion that some of Mr. Valon's figures were not correct, the point to be considered was that it was necessary to have regard to costs in the immediate future, as well as present costs, in trying to arrive at a new standard price. With reference to the points raised by the Ilford Council, a somewhat strongly worded letter had been sent to the Board of Trade dated Sept. 19. 1923, and appeared to be written on the assumption that the Company were the applicants, and were asking the Board of Trade to make the present standard price permanent. Moreover, a statement was made which was unfair, and was an example of how figures could be put in a way that tended to unfair conclusions being drawn from them. The letter stated: "The Company appear to appropriate large sums annually from revenue for the writing-down of capital assets of the undertaking during the past ten years. Notwithstanding the financial stress to which the country has been subjected, the Company have so applied about £2,000,000 in depreciation of plant, mains, and stoves." The true facts were that during the past ten years the Company had applied £1 662,754 in depreciation, and there had been £369 525 received for loss of ships. It was these two amounts added together which amounted to £2 000,000; but depreciation alone during the past ten years came to £1,662 754, or 0·6 p.ct. per annum on the capital as it stood in 1922. This was a small figure for such an enormous undertaking as that of the Gas Light and Coke Company. There was one comment he would like to make with regard to Ilford. The Ilford Company were amalgamated with the Gas Light and Coke Company in July, 1922; but before the amalgamation the standard price in Ilford was very much higher than the standard price of the Gas Light and Coke Company. The selling price in Ilford at the date of the amalgamation was 1s. 2d. per therm, which was reduced to 11d. per therm in the following September quarter, to 10d. per therm in the December quarter of 1922, and to 9 2d. in the June quarter of 1923. Therefore Ilford had not much cause for complaint. He gathered from Mr. Herring that, in his view, the costs of the Company to-day were really lower than those suggested by Mr. Valon; but as Mr. Herring had put forward no alternative estimate, there was nothing but Mr. Valon's figures to be considered.

MR. MILNE WATSON'S EVIDENCE.

Mr. *D. Milne Watson* (Governor of the Gas Light and Coke Company) then gave evidence, and handed to the Director and to Counsel for the London County Council copies of the detailed estimate of the present-day costs which had been prepared by the Company. [Copies of this were refused to the Press.] Dealing with this estimate, he said it related to what was believed would be the cost in the immediate future, and gave a total expenditure, including interest, of 36 72d. per 1000 c.ft. Certain adjustments were necessary in this figure, however, owing to improvements the Company had made since 1914, which brought the total figure to 38 36d. per 1000 c.ft. This would entitle the Company to a new standard price of 11·366d. per therm.

With regard to coal, he had taken a figure of 30s. per ton, which allowed a f.o.b. price of 24s. per ton. This was based on prices actually being paid, and compared with Mr. Valon's 29s. per ton. Though the Company had been fortunate in buying their coal for this year at exceptionally favourable prices, it was not likely they would be able to do so again. For some coal bought since the main contracts were let, 28s. per ton f.o.b. had been paid, and the average price was 23s. per ton f.o.b. At the present moment it was quite impossible to forecast the likely position in the coal market next year. The position at home and in Europe was very uncertain. Moreover, there was a possibility of a coal strike in America next spring—about April, just when it would be most awkward for English buyers. Then there was also the possibility—which he hoped was only a possibility—of an increase in railway rates; and, as everyone knew, the miners had made demands for increased wages. This matter had not been settled yet; and he had been told that if the miners got all they asked, and the companies got their share also—which the miners agreed they should have—it would mean a rise of 9s. per ton in the price of coal in this country. They were the risks; and to ask for exactly the same figure for coal for next year as prevailed at present was asking too much, in the uncertain state of affairs which seemed likely. Personally, he considered the figure of 30s. extremely moderate. Originally he had a higher figure in the estimate; but, in any case, no one knew what the future held in this respect. Only the other day he had been quoted 24s. 1d. f.o.b. for second-class coal for 1924; and adding 5s. 11d. for freight—the actual figure—made a price of 30s.

As to coke and breeze, he had taken 27s. 3d. per ton as the selling price, as against Mr. Valon's 29s.; the former being the 1922 figure. This year had been a very remarkable year for coke. A larger percentage of the Company's coke than usual had been exported, and a very good price had been obtained—as much as 40s. per ton. The reason why the export price had been good in the early part of the year was that in the past Germany used to export furnace coke to Sweden. Germany, however, instead of exporting became a buyer of English furnace coke, which had the effect of sending up the price of this. Sweden could not afford to buy English furnace coke, and so bought English gas coke, which immediately increased in price. Germany, however, was not now buying English furnace coke, which had had to find a market in Sweden. The result had been that the price of English furnace coke had fallen to 33s. per ton, and was dragging the price of English gas coke with it. As a matter of fact, there were no export buyers of English gas coke at the moment, which meant that the bottom had gone out of the market. He anticipated that, when buying recommenced, there would be a drop of 10s. per ton, and that 30s. would be the price for the coming year, against the 40s. which prevailed a short time ago. If that were so, it would knock the bottom out of Mr. Valon's 29s. per ton. Mr. Valon had assumed that coal and coke prices would always bear some relation to each other, but past experience did not confirm this. In 1914 coal cost 16s. 6d. per ton, but the price of coke was down to 12s. 10d. In 1915, coal cost 20s. 5d., but coke was 16s. Therefore, in taking coal at 30s. per ton and coke at 27s. 3d., he had been generous. In 1920, of course, the position was exceptional, because coke went up to £11 per ton in October and September; but it had fallen to £4 in December, and this showed what a slump would do. With regard to breeze, the next item on which there was a difference between the Company and London County Council, he personally did not anticipate realizing the 1922 figure, as there was great competition from slack coal.

In respect of tar, too, there were signs of a break in the market, and he had taken 4d. per gallon, against 6d. by Mr. Valon. Whereas, for instance, pitch had fetched 190s. per ton during the past year, it had now fallen to 130s. Sulphate of ammonia prices also were on the down grade, as he was only too sadly aware, being Chairman of the Sulphate of Ammonia Federation. By December next he anticipated the price would be down to £13 per ton, and he saw nothing in the sulphate market which gave much hope. There had been a very great increase in the output of sulphate all over the world. The Germans had come into the export market with large quantities, with the natural result that prices had broken all over the world. His percentage for residuals in the gross revenue, therefore, was 66 p.ct., against 60 p.ct. in 1922 and 1921, compared with Mr. Valon's 72 p.ct. The figure of 66 p.ct. was the average over the past ten years, and he regarded it as a reasonable one. All this brought the net cost of coal to 7·58d. per 1000 c.ft., against Mr. Valon's 5·72d., and a total net cost for 1922 of 9·39d.

At this stage, Mr. ABADY said the remainder of the items in the Company's estimate substantially agreed with Mr. Valon's figures, and in some cases were actually lower. In these circumstances, he did not propose to take Mr. Milne Watson through them, unless the Director required their justification.

Mr. HONEY said he did not think it necessary to go through them. The difference between the parties was remarkably small. The Company claimed that the shareholders were entitled to a standard price of 11·4d., and the L.C.C. said it should be 10 8d.

Mr. HARKER said this was the position as the case had developed, but it was not the position when they first came into the room. It meant a very great reduction.

Mr. HONEY remarked that, as the difference was so small, he hardly knew whether to suggest that the parties should discuss the question, to see whether they could eliminate this trifling difference.

Mr. HARKER said that, speaking on behalf of the London County Council, he should much prefer that the matter be left to the decision of the Board of Trade.

Mr. HERRING, for the Ilford Council, concurred in this.

Mr. ABADY then took Mr. Milne Watson to the question of improvements within the control of the Directors.

Witness said that, according to his estimate, the total cost of the production and supply of gas was 7·33d. per therm, compared with 7 6d. in 1921 and 3·34d. in 1913, and taking the difference between these two figures would give a standard price of 11·04d. The value of the economies brought about under the control of the management, however, was placed at 0·33d. per therm, which, added to the 11·04d., made 11·37d.—in round figures, 11·4d. per therm. The figure of 0·33d. per therm was arrived at in this way: It was claimed that the Company had saved freights, by their policy of purchasing steamers, to the extent of £52,000 per annum, or 0·076d. per therm. They were at present running eleven steamers, and they cost 3s. per ton, whereas the present quotation for chartered steamers was 4s. per ton. Moreover, at the present time there was a slump in shipping, so that the saving might easily be higher in normal times. Another matter was in connection with carbonization, in respect of which it was claimed that a saving of £86,000 had been made. In 1914, the make of gas was 67·04 therms per ton of coal; but it was estimated that in 1924 the make would be 70·2 therms per ton. By carbonizing as the Company were doing to-day, there was a gain of 0 85 cwt. of coke per ton of coal, but there was a loss of ½ cwt. of breeze, 1·24 gallons of tar, and about ½ gallon of ammoniacal liquor. By the present method of carbonizing, the Company were saving 94,225 tons of coal per annum, which at the net price of 10s. per ton amounted to £47,000. There was received for coke, additionally, £115,714. Against this there was the loss on account of less breeze, £32,484; the

loss on account of less tar, £41,313; and the loss on account of less ammoniacal liquor, £2672. There was therefore a net gain on residuals of £39,285, which, added to the saving in coal of £47,112, gave a total net saving of £86,397. It was also claimed that an improvement in carbonizing wages had been effected to the extent of £85,000 per annum, or 0·63d. per 1000 c.ft. The items of £52,000 on freights, £86,000 on carbonizing, and £85,000 on carbonizing wages made a gross saving of £233,000, or 0·33d. per therm, which, added to the saving already shown of 3·44d. per therm, made a total difference since the last Therm Order of 3·77d. Giving the Company the credit of these improvements, made the new standard price 11 37d. per therm—say, 11·4d. If the Company were not allowed this credit for improvements within their own control, it simply meant there was no inducement to do better, which the sliding-scale clearly contemplated there should be. In other words, the Company would be penalized.

Speaking of the present charge for gas, Mr. Milne Watson said it was extremely doubtful whether the existing price of 8·6d. per therm could be maintained. As a matter of fact, the average price over the year 1923 would be 9·1d. per therm, as the price of 8·6d. did not operate over the whole year. He might be asked why the price had been reduced, if there was no prospect of maintaining the reduction; but his answer was that the price had dropped as the result of buying coal favourably, and it was thought that the consumers should get the benefit. The policy of the Directors was to reduce the price whenever they saw a prospect of maintaining the reduced price for twelve months ahead. After that, things must take care of themselves. A board of directors should not be frightened of putting the price down because they felt they might have to put it up again at some future time. Reducing the price whenever it was possible, even if it had to be increased later, was the right policy, in his view.

Witness, cross-examined by Mr. HARKER, agreed that the London County Council were amply justified in making this application.

Mr. HARKER put it that, in regard to rates and taxes, the Company had assumed that all their assessments were to be increased.

Witness replied that they had been increased, and at present the Board had not come to a decision with regard to an appeal.

Mr. HARKER then dealt at length with the suggested improvements since 1914, brought about within the control of the Directors, and elicited that the ships had been bought at various times since 1912, when there was one in service. Two were bought in 1921, and these were the last purchases.

Witness said the Company had bought, altogether, 26 boats; but many of them had been sunk, and 13 or 14 was the largest number that had been in service at one time. As to the improvements in carbonization, the furnaces had been improved in construction since 1914. Considerably larger grate areas had been put in; higher temperatures of working had been adopted; heavier charges of coal were used, and there were longer periods of carbonization. Generally, more scientific methods were adopted. There had been a "tightening up." One of the things which had led to this was the enormous increase in the cost of materials and coal. The engineering staff had had to go all out to do the very best possible with the materials at their disposal.

Mr. HARKER suggested that the larger furnaces were in existence before 1921, when the Company got their Therm Order.

Witness: Everything was in existence before 1921.

Yes; but you know what I am driving at.—Perfectly, and what I am driving at is that we are more scientific.

But you will agree, from your experience as the Governor of the Company, and a Director of other gas companies, that it is the duty of directors of gas companies who are discharging their functions reasonably to adopt these modern methods of gas production?—Yes; but the point is that the Act draws a distinction, and says that you are to have regard to alterations beyond the control of the undertakers.

Mr. HERRING adopted the general cross-examination of Mr. Harker, and put one or two special questions with regard to depreciation; the unintentional inference being led up to that sums of money were being applied to this purpose which did not appear on the accounts. Later, Mr. Herring said he had no intention of suggesting that there was anything improper.

Mr. HONEY suggested that the matter be allowed to drop, after Mr. Milne Watson had emphasized that the Company's accounts were first audited by the shareholders' Auditor and then by a Government Auditor.

Mr. HERRING, however, complained that the Company were depreciating ships and debiting the amount to coal.

Witness said he failed to see where else it could go.

Mr. HERRING also complained that there was nothing in the capital account to show that any ships had been bought.

Witness replied that it was not usual to specify in a capital account the precise plant purchased.

This closed the case for the Company.

MR. HARKER'S REPLY.

Mr. HARKER, addressing the Director in his general reply on the whole case, suggested that it would be of assistance in regard to the other cases of the same nature which were coming on if the Board of Trade would arrive at some decision on the matter of what has to be taken into account in fixing a new standard price in these circumstances. Reading the strict wording of the proviso, he felt bound to agree with the view put forward by the Company that, if the Company could satisfy the Board of Trade that between the time of the original Therm Order and the application for a revision there had been alterations in the costs and charges of, and incidental to, the production and supply of gas due to circumstances within the control of the Company, or not due to the other circumstances provided by the proviso to subsection of section 1 of the Act, then those alterations should not be taken into account in determining the new standard price. This seemed to him to be the only possible construction of the proviso, though he was afraid, in saying this, he would be differing from Mr. Herring. The Company, however, were claiming the advantage of any improvements of this nature since 1914, which was contrary to what the Act said. Judged from this standpoint, his case was that the ships the Company owned were in operation before the date of the original Therm Order, and that all the other economies for which credit was claimed were in operation at the time the Therm Order was applied for. If the Company's claim for credit for the 0·33d., which they said represented the improvements since 1914, was disallowed—and he asked that it should be—then there was a very small difference between the estimates of Mr. Valon and Mr. Milne Watson, and the London County Council would feel quite safe in leaving the matter to the judgment of the Board of Trade.

The inquiry then closed.

GAS REGULATION ACT APPLICATIONS.

The following further notices have appeared in the "London Gazette" with regard to applications to the Board of Trade for Orders under the Gas Regulation Act.

Bedwellty Urban District Council.

The maximum prices now authorized in respect of the supply of gas by the undertakers are 5s. and 5s. 6d. per 1000 c.ft.; and the price they have asked the Board of Trade to substitute for these is 1s. 10d. per therm.

DECLARATIONS OF CALORIFIC VALUE.

Glyncorrwg Urban District Council.—425 B.Th.U. (Jan. 1, 1924.)
Huyton and Roby Gas Company.—500 B.Th U. (Dec. 31.)
Llanidloes Gas, Coal, and Coke Company, Ltd.—480 B.Th.U. (Feb. 1, 1924.)
Sidmouth Urban District Council.—480 B.Th.U. (Jan. 1, 1924.)

GAS REGULATION ACT ORDERS.

We have received from the Director of Gas Administration copies of the following further Orders made by the Board of Trade under section 1 of the Gas Regulation Act.

Walsall Corporation.

After the declared date, the maximum price in respect of gas supplied by the undertakers shall be 15d. per therm. (Nov. 15.)

West Bromwich Corporation.

After the declared date, the maximum price in respect of gas supplied by the undertakers shall be 14d. per therm. (Nov. 15.)

Cheaper Gas for Durham.—The Directors of the City of Durham Gas Company have decided to reduce the price of gas to 3s. 9d. per 1000 c.ft. in the city, and 4s. per 1000 c.ft. in the outside area, as from the December reading of the meters.

New Consumers and Deposits.—At a recent meeting of the Hull Corporation Gas Committee, the Engineer requested the instructions of the Committee with regard to taking deposits from new consumers for gas supplies. Mr. Stark moved, and Mr. Richardson seconded, that a deposit be required from new consumers. Mr. Mohan moved, and Mr. Newham seconded, as an amendment, that deposits from consumers in respect of gas supplies be dispensed with. The amendment was lost and the original motion carried. The Committee then resolved that the interest payable to new consumers in respect of gas deposits be 4 p.ct.

Mr. W. B. M'Lusky Pushes Industrial Gas.—Before the Halifax Textile Society, on the 7th inst., Mr. W. B. M'Lusky, General Manager and Engineer of the Halifax Gas Works, lectured on "The Functions of Gas in Relation to Light, Heat, Ventilation, and Power in the Factory." Mr. T. W. Cordingley presided over a large attendance. Mr. M'Lusky said that the merits of the inverted gas-mantle were its excellent light, a comfortable warmth, and a tendency to remove or destroy impurities in the atmosphere. The principal London hospitals were now lighted and heated by gas, because it had been scientifically proved that it burned up the microbes. In regard to heating, where the demand was fairly constant, a mixture of boiler coal, steam slack, and gas coke was the cheapest heat agency; while gas heating was excellent for intermittent work. He admitted that electricity had a tremendous field for the transmission of power, being the most useful form of energy for that purpose; but it could never be a prime mover. They could not drive a ship or factory by electricity without having water power, boilers, or internal-combustion engines.

Oriental Gas Company, Ltd.—At the meeting of shareholders next Wednesday (Nov. 28) the Directors will submit the accounts for the financial year ended June 30 last. In doing so, they will report that they have the satisfaction of presenting a revenue account which shows a sale of gas well in excess of the corresponding receipts for the financial year ended June 30, 1922, which were until now the highest figures attained in the history of the Company. The actual increase is £10,985. The amount yielded by the sale of residual products also is higher than that of the previous financial year by £1374. To sum up, exchange has favoured the Company to the extent of £15 0s. 2d., as against a loss of £212 10s. 3d. last year. The total sum of credits to revenue is £150,813, or £12,376 more than that for the previous year. The completion of the new gasholder, and the prosecution of other important operations in connection with the equipment and plant rendered necessary by the growth of the Company's business, have been prominent events of the year. There has been no delay arising from labour unrest as a year ago, the relations with the men being harmonious; but climatic conditions have been exceedingly trying. A period of excessive heat, far exceeding all previous records, and bringing with it much sickness, was one source of delay; and this was followed by an alarming earthquake, which, however, wrought no great damage to the works. The Directors recommend the payment on the 29th inst. of a dividend at the rate of 4½ p.ct., less income-tax, making, with the interim dividend of 3½ p.ct., less tax, paid in May last, a total dividend of 8 p.ct., less tax, for the year.

THE NORTH-EAST COAST COAL TRADE.

From our Own Correspondent.

Any signs of weakness which may have been noticeable in the previous week have entirely disappeared, and the past week closed in a firm tone. Tonnage has been plentiful, and, under a brisk demand for coal, any available quantities were quickly taken up. It is generally considered that the market is now assured up till the end of March. For the remainder of this year collieries have very little available coal. Durham unscreened are now asking 24s. 6d. f.o.b., for best qualities of coking. This has been done, and is expected to be readily obtainable this week. The demand for gas coal is still slack as compared with other sorts. Wear specials and best qualities are quoting 24s. 6d., but are probably obtainable at 24s. f.o.b., and seconds 22s. 6d. to 23s. 6d.

Forward business over next year is still hard to place. Collieries remain firm at their quotation of 24s. for best sorts; but actual consumers do not seem ready to pay this price, and beyond speculative purchases here and there by merchants little has been done. It is recognized that Germany will be the key to the whole situation; and in the present uncertainty as to what might happen there, collieries are unwilling to sell at below current rates, and buyers prefer to wait.

The new berths at West Dunston have made an excellent start, and promise to be a valuable acquisition to the shipping facilities of the Tyne.

YORKSHIRE AND LANCASHIRE COAL TRADE.

From a Local Correspondent.

There is a good local demand for the best selected house coals; but the secondary descriptions up to the present have rather hung fire, and collieries have been offering them quite freely at prices equal to those operating of late. With the colder weather it is anticipated there will be an equal demand for the coals in question.

The General Election is interfering with the conduct of general industries, and the policy which should be adopted is one expressed in the phrase "Wait and see." There is, however, no improvement in the consuming areas, and prices as a result remain slightly below those of a few weeks ago.

The gas section is well bought ahead, and, therefore, there is no surplus of gas coal on the market.

There is a decided lull in the request from abroad, especially from Germany, France, and Belgium, due, no doubt, to the complicated situation on the Ruhr.

COAL TRADE IN THE MIDLANDS.

From our Local Correspondent.

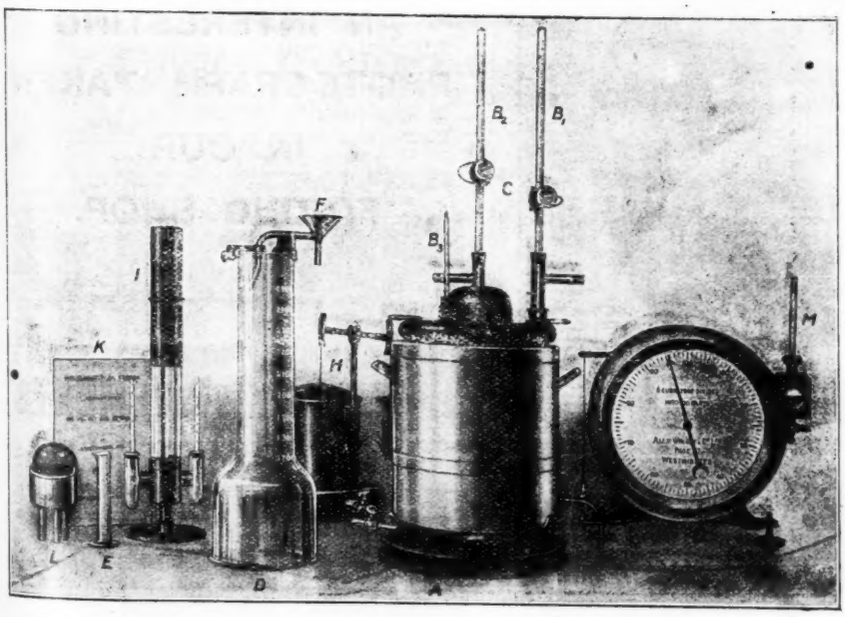
More severe weather has keyed up the whole position in the home trade, assisted as it has been by the heavier lighting load and a rather better industrial demand. The activity of the export market remains a primary factor. It has played an important part in relieving local congestion, and is indeed setting up conditions of stringency in some directions. The strong inducement that existed not many weeks ago to press deliveries on gas-works faster than they could be accommodated no longer operates. Apart from the increased carbonization, the situation is relieved by the larger quota taken by collateral departments of consumption. Moreover, the strain upon rolling stock resources makes prompt handling imperative if trouble is to be avoided.

Merchants can only get supplies of some qualities of coal now by sending their own wagons to transport it from the collieries. Minor interruptions of traffic have occurred through the occupation of wharves from the unloading of merchandize from boats which have been held up by the partial strike on the canals. Traders in the distributive channels cannot afford to work on hand-to-mouth lines now. They have to look ahead if they are to make sure that their supplies of coal will be ready as they are required. Collieries have a few weeks' orders in hand, and are more independent. The output is equal to the demand; but the risks of delay at the pit bank and in transit have increased. Nuts and beans are firm under the pressure of a brisk demand. The home market for slacks maintains its improvement, and there are still good openings overseas.

Reports of freer conditions with regard to furnace cokes do not receive confirmation when brought to the test of actual business. The cokeries are disinclined to sell at the current rate of 24s. at ovens beyond the present month, pending a further conference.

Geyser Fatality at Lewisham.—At a Lewisham inquest on the body of Mr. C. J. Hibbard, who was found in his bath in an unconscious condition, and subsequently died, a verdict of "Death from accidental causes" was recorded. The bathroom was a small one, in a bungalow; and the geyser had been brought from another house and fixed only a few weeks ago. A sister said deceased was a qualified chemist on the staff of a gas-engineering firm. A mechanical engineer living near stated that an examination of the apparatus did not lead him to suppose that it was improperly fixed. There was a flue pipe leading outside, with a tee head, and an additional ventilator inside the room. He noticed, however, a down-draught from the outlet pipe, which blew the gas-jets in a downward direction. He did not care to offer an opinion about the geyser being choked. His own view was that the accident was due to the force and direction of the wind.

BOYS CALORIMETER



GAS REGULATION ACT, 1920.

CALORIMETER

as prescribed

by

GAS REFEREES.

ALEXANDER WRIGHT & Co., Ltd.,

1, WESTMINSTER PALACE GARDENS,

WESTMINSTER, S.W. 1.

TRADE NOTES.

Large Orders.

Newton, Chambers, & Co., Ltd., have secured a contract from the Admiralty for steelwork for the new Naval Base at Singapore. The work consists of the supply and erection of eleven steel oil-fuel storage tanks of the largest size. The firm have also been successful in securing an order for a large gas purifying plant for the South of England, and also a gasholder of considerable size for Liverpool.

Glover-West Vertical Retorts.

We are informed that the following contracts have been recently placed for installations of Glover-West vertical retorts. At Darlington, the existing installation, which has been working since September, 1914, is to be extended by the addition of two settings containing sixteen retorts of the new model, increasing its capacity by about 800,000 c.ft. of gas per diem. The whole plant will be employed in the carbonization of about 216 tons daily of Durham coals. The Dundalk Gas Company have placed an order for four retorts of the new model. It is interesting to note that, as the annual make of this undertaking is 41 millions, and the daily capacity of the new plant will be ¼ million c.ft., it has been decided to set the retorts in three units—one of two retorts, and two of one retort each. At Wellington (N.Z.), the existing installation, which was put into operation in September, 1914, is to be extended by the addition of 32 retorts of the new design.

Further Reduction at East Cowes.—The Directors of the East Cowes Gas Company announce a further reduction of 1d. per therm (equivalent to 4¾d. per 1000 c.ft.) in the price of gas supplied through ordinary meters, this to take effect from Dec. 28. This will make the charge 13d. per therm. From the same date an increased rebate will be allowed to prepayment consumers.

War Memorial Tablet at Sunderland.—A bronze tablet placed on the outside wall at the general office at the Hendon works of the Sunderland Gas Company, in memory of 22 men of the Hendon and Ayre's Quay Works who gave their lives in the war, was unveiled on Monday of last week by Alderman W. F. Vint, the Chairman of the Company. Mr. C. Dru Drury (the Engineer) said that during the war 170 of the staff and men at the two works served in either the army or the navy. The treatment by the Company of the men who joined up had been generous, and the policy of the Company of employing as many ex-service men as possible was being carried out to the fullest extent. At present there were 160 ex-service men in the Hendon and Ayre's Quay Works. Alderman Vint referred to the great sacrifices made during the war by those who served in the forces, and said he felt it an honour to unveil that tablet to those who had given their lives in order that right might be upheld.

CURRENT SALES OF GAS PRODUCTS.

The London Market for Tar, Tar Products, and Sulphate.

LONDON, *Nov.* 19.

There is nothing of interest to record in the London tar products market; all the products remaining about the same as last reported.

Tar Products in the Provinces.

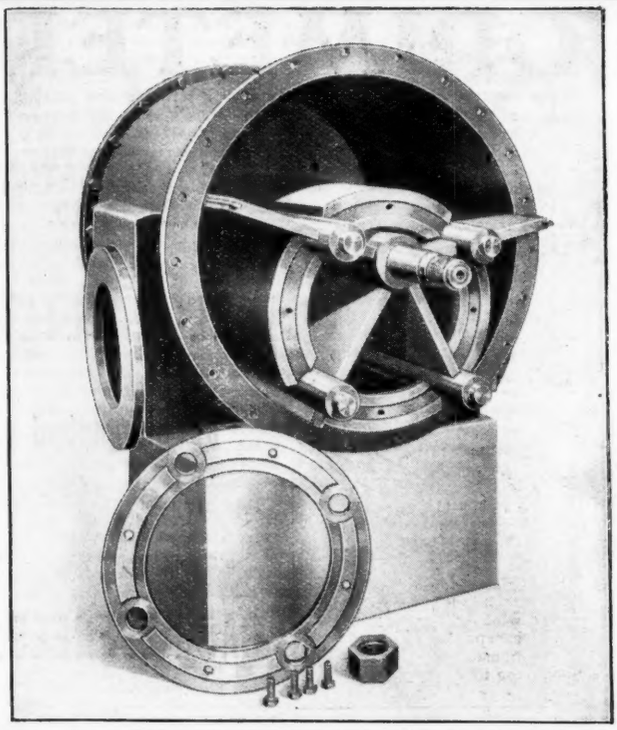
Nov. 19.

Business in tar products has again been quiet during the past week. Buyers of pitch appear to be still holding off in the hope that prices will go lower. Creosote is very firm, and there is a good inquiry for prompt and forward delivery.

The average values for gas-works products during last week were: Gas-works coal tar, 76s. to 81s. Pitch, East Coast, 130s. to 132s. 6d. f.o.b. West Coast—Manchester, 125s. to 127s. 6d.; Liverpool, 126s. to 128s. 6d.; Clyde, 127s. to 130s. Benzole 90 p.ct., North, 1s. 0½d. to 1s. 1d.; crude 65 p.ct. at 120° C., 9½d. to 10d. naked at makers' works; 50-90 p.ct., naked, North, 1s. 5d. to 1s. 7d. Toluole, naked, North, 1s. 5d. to 1s. 7d., nominal. Coal tar crude naphtha in bulk, North, 8d. to 8½d. Solvent naphtha, naked, North, 1s. 2½d. to 1s. 4d. Heavy naphtha, North, 1s. 5½d. to 1s. 7½d. Creosote, in bulk, North, liquid, 8d. to 8½d.; salty, 7½d. to 8d.; Scotland, 6¾d. to 7½d. Heavy oils, in bulk, North, 8½d. to 9d. Carbolic acid, 60 p.ct., 3s. 4d. to 3s. 5d. prompt. Naphthalene, £15 to £16; salts, £6 to £8, bags included. Anthracene, "A" quality, 4d. per minimum 40 p.ct., purely nominal; "B" unsaleable.

Statutory Companies and the Use of Public Streets. — The London County Council adopted, without discussion, at their meeting last week, the finding of the General Purposes Committee, reproduced on p. 461 of last week's "JOURNAL," to the effect that "the grant to private statutory companies of the right to use public streets without charge for the purpose of laying down pipes or wires ought not to involve an obligation upon the local authorities to keep such streets unaltered for ever, or, if they be altered, to bear the cost of any necessary removal and relaying of the pipes or wires."

Tuscan Gas Company.—Meetings of debenture holders of the Tuscan Gas Company are to be held to-morrow (Thursday) to consider a scheme of arrangement under which £100,000 6 p.ct. first debenture stock will be created, and will be allotted to the extent of an equivalent amount of the principal, premium, and arrears of interest to March 31 last (£85,701 5s. in all), of the existing debentures. The new debenture stock will be a floating charge on the Company's property. The Company will in the year ending March 31, 1926, and each subsequent year, pay £4137 16s. 1d. for the redemption of the stock by purchase at or below par; and the stock, if not previously redeemed, is to be repaid at par on March 31, 1940.



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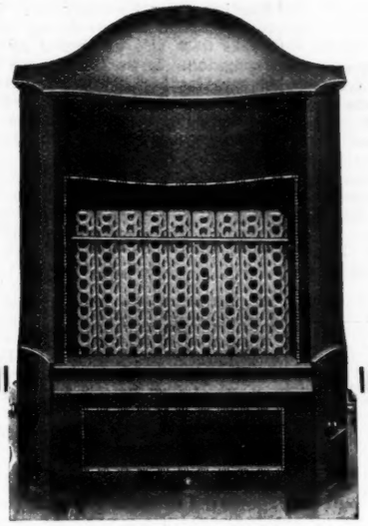

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PATENT "STELLA" FIRE.
Registered Design.

Substantial Reduction at Peebles.—The price of gas supplied by the Peebles Town Council will, after the present survey, be reduced from 5s. per 1000 c.ft. to 3s. 9d. and 3s. 4d. for commercial purposes. This is the second reduction of 1s. 3d. within two years.

Wandsworth Gas Price Reduction.—The Wandsworth, Wimbledon, and Epsom District Gas Company announce that the price of their gas will be reduced by three-fifths of a penny per therm as from Christmas. Approximately this means a reduction of 3d. per 1000 c.ft.

Gas for Generating Electricity.—Two years ago the Electricity Department of the Buxton Corporation decided to adopt gas, instead of coal, for generating current. While on March 31, 1922, there was a loss on the concern of £1238, on March 31 of this year there was a profit of £3500.

New Gas Showroom at Gateshead.—In order to provide a thoroughly up-to-date showroom for their many customers on the south side of the river, the Newcastle and Gateshead Gas Company have carried out extensive alterations to the branch in West Street, Gateshead. The Company do not seek to monopolize the sale of gas appliances, but endeavour to encourage the business of all other dealers, both in Newcastle and Gateshead, by the display of efficient fittings in the showrooms.

Derby Gas Company.—The Directors of the Derby Gas Light and Coke Company have decided to do their part in solving the unemployment problem; and a considerable number of men are to be employed this winter upon new works, on reconstruction of the existing plant, and on renewals and extensions of gas-mains. The Company will give preference to ex-service men and other unemployed Derbyshire men. Already 100 extra men are employed at the Litchurch works of the Company; and this number will shortly be increased.

Cheap Gas at Middlesbrough.—Alderman Sir Joseph Calvert (the Chairman of the Middlesbrough Corporation Gas Committee), in a recent address on municipal topics, said Middlesbrough was in an excellent position, in that its method of conveying and cleansing surplus gas from coke-ovens was better than in some places which had since adopted similar sources of supply. Cheap gas had been a great boon to the poor of Middlesbrough during the war. The gas undertaking, instead of being a "white elephant," was now one of the most profitable concerns belonging to the community of Middlesbrough.

Shanklin Gas Consumers' "Christmas Box."—Intimation is made by the Shanklin Gas Company that, as from the reading of the meters at the Christmas quarter, the price of gas will be reduced to 13·34d. per therm, equal to a reduction of 8d. per 1000 c.ft. The same reduction will apply to prepayment consumers. With the news of this liberal reduction comes the announcement that the Company, to help in reducing unemployment, have decided to lay a main to Wroxall, the inhabitants of which village have expressed a strong desire to have a gas supply. The main will be 3¾ miles long; and an outlay of some £4000 is involved in the scheme. Mr. Frank C. Taylor, the Engineer and Manager, is to be congratulated upon the rapid strides made by the Company.

Extensions at Birkenhead.—At a meeting of the Birkenhead Corporation the Gas Engineer (Mr. H. E. Stone) intimated that he had, with a view to providing work for the unemployed, had a canvass made of the Upton district (within the area of supply of the Corporation), with the object of obtaining information as to whether there was a sufficient demand for gas to warrant the extension of mains to that district, and reported the result. He also reported that the work, if proceeded with, would provide employment for 30 men for a period of 36 weeks. The Corporation decided that application be made to the Ministry of Health for sanction to the borrowing of £7856, being the estimated cost of the work, the loan to be repaid within a period of thirty years—also subject to the Unemployment Grants Committee contributing towards the interest on the loan.

Leeds Public Services Exhibition.—The Leeds Health and Municipal Services Exhibition (opened at Fenton Street Drill Hall on the 13th inst.) is the first of its kind in the country. It was the leading feature of the Leeds Health Week campaign, and is being continued to Dec. 1. It aims at giving the necessary publicity to the health and other municipal departments. The exhibition has been assembled under the joint direction of Dr. J. J. Fervis (Medical Officer of Health), Mr. C. S. Shapley (Engineer and General Manager of the Gas Department)—whose enthusiasm for publicity for his department is unbounded—and Mr. C. N. Hefford (City Electrical Engineer). With the assistance of a few private manufacturing firms, the whole of the extensive exhibition space of the hall is occupied. The gas department exhibit includes lighting, heating, cooking, and power apparatus, showing how warmth and energy can be generated cheaply and effectively by gas. Diagrams illustrating the injurious effects of smoke pollution on property and on health, effectively link up the gas exhibit with that of the health department. All other municipal departments are included in the show.

Walsall Gas Prices.—The Gas Committee of the Walsall Town Council, at a meeting of the Council last week, reported a revision of prices for gas, to take effect from the December readings of the meters, which will mean a reduction of 6d. per 1000 c.ft. for all consumers, except slot-meter users. The new prices will be 3s. 6d. per 1000 c.ft. for householders, and for those using gas for power 3s. to 3s. 4d., according to the quantity consumed. The price to slot-meter consumers will be 4s., instead of 4s. 2½d. There was a good deal of discussion on the inadequacy of the public lighting in certain parts of the borough, of which complaints have been made at previous meetings of the Council. Alderman M. Somerfield stated that the Public Works Committee's estimates were cut down so ruthlessly that they were unable to light the additional lamps. Alderman E. H. Ingram said he had no doubt that Walsall was the worst lighted town of its size in the country. A recommendation to pay Mr. Elijah Stackhouse, the chief collector of the gas undertaking, £200 a year for the remainder of his life, on the condition that he would render to the undertaking such service as he was called upon to do, was approved. Mr. Forsyth and other members urged the necessity for facilitating the establishment of a superannuation scheme for officials, to obviate this granting of pensions.

STOCK MARKET REPORT.

ALTHOUGH the definite announcement of the date of the General Election has relieved to some extent the anxieties of the investing public with regard to possible political happenings, the general tone of the Stock Market was decidedly below par last week. Prices continued to fall in spite of spasmodic improvements. The American Exchange continued to move against us—dropping on the week from $4.39\frac{3}{8}$c. to $4.31\frac{3}{8}$c. This rate compares with $4.53\frac{1}{4}$c. a month ago. The rapid fall, owing partly to the necessity of buying dollars to pay interest on American debts, is far-reaching in its effects, the Stock and Money Markets attributing the depression in stock values and the increased indisposition to take bills to this cause. At the close of the week, firmness was displayed in British Funds; the 5 p.ct. Loan closing at $100\frac{1}{8}$, $3\frac{1}{2}$ p.ct. Conversion Loan $76\frac{3}{8}$, Funding Loan $87\frac{1}{4}$, and Victory Bonds $90\frac{1}{8}$.

In the Foreign Market, French Rentes weakened on another fall in the franc. Industrials generally were quiet. South Africans received good support during the week. Gas stocks were also unaffected by the universal depression. It was noticeable, however, that in the Gas Light ordinary there was a sharp move upward, possibly due to the favourable impression of the proceedings at the Board of Trade inquiry held on Wednesday, to which we referred last week.

The following price changes in Gas stocks took place on the London Stock Exchange last week: Rise, Continental Union ordinary 2 to 30-35, and 7 p.ct. preference 5 to 80 85; fall, European $\frac{1}{2}$ to $7\frac{3}{4}$-$8\frac{3}{4}$, Gas Light ordinary 1 to 93 95, and 4 p.ct. preference 1 to 78 81, Imperial Continental ordinary 9 to 143-148 *ex* div, South Metropolitan ordinary $\frac{1}{2}$ to 97 99, Southampton 5 p.ct. maximum 2 to 86-89 *ex* div.

The following transactions were recorded during the week: On Monday, Brentford "A" $102\frac{1}{4}$, 103. Brighton and Hove "A" 130, Commercial $3\frac{1}{2}$ p.ct. 95, Gas Light 92, $92\frac{1}{4}$, 93, $93\frac{1}{8}$, $3\frac{1}{2}$ p.ct. maximum 66, $66\frac{1}{4}$, 4 p.ct. preference 80, Imperial Continental 151, 152, 154, Liverpool 7 p.ct. preference 106, $106\frac{1}{2}$, Primitiva 6*s.*, South Metropolitan 97, $97\frac{1}{2}$, 98. Supplementary prices, Southend 5 p.ct. "B" 90, $90\frac{1}{2}$. On Tuesday, British 122, 7 p.ct. preference 122, Commercial 4 p.ct. 95, $96\frac{1}{2}$, $3\frac{1}{2}$ p.ct. 95, Gas Light and Coke $92\frac{1}{8}$, $92\frac{3}{8}$, 93, $93\frac{1}{8}$, $3\frac{1}{2}$ p.ct. maximum $65\frac{1}{2}$, 4 p.ct. consolidated preference 79, 3 p.ct. consolidated debenture 62, Imperial Continental 150, 151, Primitiva 5*s.*, 5*s.* 6*d.*, 6*s.*, 5 p.ct. preference 25*s.*, 4 p.ct. debenture $55\frac{1}{16}$, $55\frac{3}{8}$, South Metropolitan 97, $97\frac{1}{2}$, $97\frac{3}{4}$, $98\frac{1}{2}$, Swansea $6\frac{1}{2}$ p.ct. debenture $105\frac{1}{2}$. Supplementary prices, Danish $5\frac{11}{16}$, 5 p.ct. preference $6\frac{3}{8}$, Southend 5 p.ct. "B" $89\frac{1}{2}$, 90, Wandsworth $3\frac{1}{2}$ p.ct. new $102\frac{1}{2}$, 103. On Wednesday, Brentford "A" 102, 103. British Gas Light 7 p.ct. preference 123, Commercial 4 p.ct. $95\frac{1}{2}$, 3 p.ct. debenture 60, Continental Union $32\frac{1}{2}$, Gas Light and Coke $92\frac{1}{8}$, 93, $93\frac{3}{8}$, $93\frac{1}{2}$, 4 p.ct. preference 78, 3 p.ct. debenture $62\frac{1}{4}$, $62\frac{1}{2}$, Imperial Continental 147, 150, Montevideo 52, Primitiva 5 p.ct. preference 25*s.* 6*d.*, South Metropolitan 97, $97\frac{1}{2}$, $97\frac{7}{8}$, South Suburban $102\frac{1}{4}$. Supplementary prices, Leatherhead 5 p.ct. 11, $11\frac{1}{2}$. On Thursday, Commercial 4 p.ct. $96\frac{1}{4}$, Continental Union $32\frac{1}{2}$, 34, European 8, $8\frac{3}{32}$, Gas Light and Coke 92, $92\frac{3}{8}$, 93, $93\frac{1}{8}$, 4 p.ct. preference 78, Primitiva 5 p.ct. preference 25*s.*, Sheffield "A" $101\frac{1}{2}$, South Metropolitan 97, 98, Swansea 7 p.ct. preference $103\frac{1}{2}$, Tottenham "B" 102. Supplementary prices, Bahia Blanca "B" $5\frac{1}{2}$*d.*, Barnet "C" 153, Hertford 10 p.ct. maximum 16. On Friday, Continental Union 34, 7 p.ct. preference 84, Gas Light and Coke 93, $93\frac{1}{8}$, $93\frac{3}{8}$, $93\frac{7}{8}$, 94, $94\frac{1}{8}$, $3\frac{1}{2}$ p.ct. maximum $65\frac{1}{2}$, 4 p.ct. preference $79\frac{1}{2}$, 3 p.ct. debenture $62\frac{1}{2}$, Imperial Continental $144\frac{1}{2}$, 145, 146 *ex* div., $3\frac{1}{2}$ p.ct. debenture $76\frac{1}{2}$, 77, Newcastle and Gateshead $3\frac{1}{2}$ p.ct. 85, $85\frac{1}{4}$, South Metropolitan 97, $97\frac{1}{2}$, $97\frac{7}{8}$. Supplementary prices, Southend 5 p.ct. "B" $89\frac{1}{2}$, 90.

In the Money Market, the average rate at which Treasury Bills were sold was $3\frac{5}{16}$ p.ct. Discounts were firm, quotations reaching nearly $3\frac{7}{16}$, and overnight money was obtainable at $2\frac{1}{2}$ p.ct.

Silver rose on the week to $32\frac{7}{8}$d. per oz.

The weakness of the Continental Exchanges was conspicuous at the close of the week. French francs closed at 81.10, Belgian francs at 95.00, and Dutch florins at 11.62½.

The Bank of England rate remains at 4 p.ct., to which figure it was raised from 3 p.ct. on July 5.

ANTE-WAR PRICES AND DIVIDENDS, LATEST DIVIDENDS, AND LAST WEEK'S TRANSACTIONS.

Issue.	Share.	When ex-Dividend.	Ante-War Dividend & Bonus.	Last Divid. at Rate of	NAME.	Closing Prices, July 30, 1914.	Variation. Quotations, Nov. 16.	Variation. Lowest and Highest Prices of Transactions.
£			p.c.	% p.a.				
131,978	Stk.	Aug. 9	—	5	Aldershot 5 p.c. max. C.	..	72—77	...
227,992	,,	,,	4	4	Do. 4 p.c. Pref.	..	70—75	...
1,551,868	,,	Oct. 4	$2\frac{1}{2}$	$5\frac{1}{2}$	Alliance & Dublin Ord.	59—64	68—73	...
374,000	,,	July 12	4	4	Do. 4 p.c. Deb.	76—79	62—67	...
280,000	5	Oct. 18	$7\frac{1}{2}$	8	Bombay, Ltd.	$5\frac{1}{2}$—$6\frac{1}{2}$	$5\frac{1}{2}$—$5\frac{5}{8}$	...
100,000	10	Aug. 9	16	$8\frac{1}{2}$	Bournemouth Gas and Water { 5 p.c.	..	$12\frac{1}{2}$—$13\frac{1}{2}$	...
					B 7 p.c.	15—15$\frac{1}{2}$	$11\frac{1}{2}$—$12\frac{1}{2}$	...
383,110	10	,,	7	7	Pref. 6 p.c.	$13\frac{1}{2}$—14	11—12	...
115,000	10	,,	6	6	4 p.c. Deb.	..	77—82	...
162,025	—	June 28	—	4	Brentford A Consolid.	261—266	100—105	$102\frac{1}{2}$—103
992,045	Stk.	July 12	14	$6\frac{5}{16}$	Do. B New	204—209	100—105	...
734,920	,,	,,	11	$6\frac{1}{2}$	Do. 5 p.c. Pref.	109—111	90—95	...
35,000	,,	,,	5	5	Do. 4 p.c. Deb.	91—93	77—82	...
821,400	,,	June 14	4	4	Brighton & Hove Orig.	208—213	175—180	...
214,745	,,	Aug. 23	11	$11\frac{1}{2}$	Do. A Ord. Stk.	154—159	127—132	130
844,200	,,	,,	8	$8\frac{1}{2}$	Bristol 5 p.c. max.	..	95—96*a*	...
1,887,500	Stk.	July 26	5	5	British A Ord.	44—45	122—127	122
570,000	20	Oct. 4	$12\frac{1}{2}$	12	Do. 7 p.c. Pref.	..	122—127	122—123
100,000	10	June 28	—	7	Do. 4 p.c. Deb. Stk	88—90	75—80	...
120,000	Stk.	,,	4	4	Cape Town & Dis., Ltd'	$1\frac{1}{2}$—$2\frac{1}{2}$	7—8	...
100,000	10	May 17	—	7	Do. 4$\frac{1}{2}$ p.c. Pref.	4—6	6—7	...
100,000	10	Oct. 31	—	$4\frac{1}{2}$	Do. 4$\frac{1}{2}$ p.c. Deb. Stk.	70—75	75—80	...
150,000	Stk.	June 28	$4\frac{1}{2}$	$4\frac{1}{2}$	Cardiff $7\frac{1}{2}$ p.c. Deb.	..	108—113	...
237,860	,,	,,	—	$7\frac{1}{2}$	Chester 5 p.c. Ord.	108—110	85—90*b*	...
157,150	,,	Aug. 9	5	5	Commercial 4 p.c. Stk.	106—108	95—98	95—96$\frac{1}{2}$
1,513,280	,,	July 25	5/9/4	6	Do. 3$\frac{1}{2}$ p.c. do.	103—105	95—98	95
560,000	,,	,,	$5\frac{1}{2}$	6	Do. 3 p.c. Deb. Stk.	69$\frac{1}{2}$—71$\frac{1}{2}$	60—64	60
475,000	,,	June 14	3	3	Continental Union, Ltd.	76—79	30—35	32$\frac{1}{2}$—34
800,000	,,	14 Jan. 15	4	—	Do. 7 p.c. Pref.	115—118	80—85	84
200,000	,,	Dec. 14	7	4	Croydon sliding scale.	..	102—105	...
660,000		Aug. 9	—	$6\frac{1}{2}$	Do. max. div.	..	85—88	...
284,975		,,	—	5	Derby Con. Stk.	123—125	107—110*c*	...
492,270	Stk.	,,	6	$4\frac{1}{2}$	Do. Deb. Stk.	102—104	74—76*c*	...
55,000	,,	—	4	4	East Hull 5 p.c. max.	..	..	...
209,000	,,	—	—	5	European, Ltd.	17$\frac{1}{2}$—18	7$\frac{1}{2}$—8$\frac{1}{2}$	8—8$\frac{3}{32}$
1,002,180	10	July 12	10	5	Gas Light & Coke { 4 p.c. Ord	98—102	93—95	92—94$\frac{1}{2}$
16,546,120	Stk.	July 26	4/17/4	$5\frac{1}{2}$	3$\frac{1}{2}$ p.c. max.	76—79	65—68	65$\frac{1}{2}$—66$\frac{1}{2}$
2,600,000	,,	,,	$3\frac{1}{2}$	$3\frac{1}{2}$	4 p.c. Con. Pref.	96—99	78—81	78—79$\frac{1}{2}$
4,062,235	,,	,,	4	4	3 p.c. Con. Deb.	72$\frac{1}{2}$—74$\frac{1}{2}$	61$\frac{1}{2}$—64$\frac{1}{2}$	62—62$\frac{1}{2}$
4,761,930	,,	June 14	3	3	10 p.c. Bonds	..	..	...
130,000	,,	Dec. 11	10	10	7$\frac{1}{2}$ p.c. Ilford Deb.	..	..	...
42,000	—	—	—	7$\frac{1}{2}$	Hastings & St. L. 5 p.c.	..	93—98	...
82,500	,,	Sept. 19	5	$6\frac{2}{3}$	Do. 5$\frac{1}{2}$ p.c.	87—89	78—83	...
258,740	,,	,,	$3\frac{1}{2}$	$5\frac{1}{2}$	Hongkong & China, Ltd.	16$\frac{1}{2}$—16$\frac{3}{4}$	16—17	...
70,000	10	Oct. 18	11	10	Horsley 7 p.c.	..	144—149	...
86,600	Stk.	Aug. 23	9	$9\frac{1}{2}$	Imperial Continental	150—160	143—148*	144$\frac{1}{2}$—154
1,976,000	,,	Nov. 15	9	5	Do. 3$\frac{1}{2}$ p.c. Deb. Red.	84—86	76—78	76$\frac{1}{2}$—77
401,400	,,	Aug. 9	$3\frac{1}{2}$	$3\frac{1}{2}$	Lea Bridge Ord. 5 p.c.	119—121	95—100	...
235,242	,,	,,	$6\frac{1}{2}$	$6\frac{1}{2}$	Liverpool 5 p.c. Ord.	—	92$\frac{1}{2}$—93$\frac{1}{2}$*b*	...
2,127,240	,,	Aug. 23	10	$5\frac{1}{2}$	,, 7 p.c. Pref.	..	106—109*b*	106—106$\frac{1}{2}$
600,000	,,	Sept. 19	—	7	Maidstone 5 p.c.	—	125—130	...
165,736	,,	Aug. 23	7/5/6	9	Do. 5 p.c. Deb	..	55—60	...
63,480	,,	June 28	—	—	Malta & Mediterranean Met. of Melbourne { 4$\frac{1}{2}$ p.c. Deb.	4$\frac{1}{2}$—4$\frac{3}{4}$	3$\frac{1}{2}$—4	...
75,000	5	June 14	6	7		99—101	95—98	...
50,000	100	Oct. 1	$4\frac{1}{2}$	$4\frac{1}{2}$	Montevideo, Ltd.	11$\frac{1}{2}$—12	49—54	52
341,930	Stk.	May 17	4	4	Newcastle & Gatsh'd Con.	98$\frac{1}{2}$—99$\frac{1}{2}$	85—87*d*	85—85$\frac{1}{2}$
1,875,892	,,	July 26	$4\frac{1}{2}$	$4\frac{1}{2}$	Do. 4 p.c. Pref. Stk.	..	74$\frac{1}{2}$—76$\frac{1}{2}$*d*	...
250,166	,,	Aug. 9	—	4	Do. 3$\frac{1}{2}$ p.c. Deb.	82—83	73—74*d*	...
529,705	,,	June 28	$3\frac{1}{2}$	$3\frac{1}{2}$	North Middlesex 10 p.c.	—	16$\frac{1}{2}$—17$\frac{1}{2}$	...
15,000	10	Aug. 23	—	11	,, ,, 7 p.c.	14—15	11$\frac{1}{2}$—12$\frac{1}{2}$	...
75,940	10	,,	7/14/0	$7\frac{7}{16}$	Oriental, Ltd.	117—122	97—102	...
500,000	Stk.	May 3	8	7	Plym'th & Stonh'se 5 p.c.	..	108—113	...
138,120	Stk.	June 28	—	$7\frac{1}{2}$	Portsea Island, B	128—131	100—105	...
60,000	50	Sept. 6	13	13	Do. C	118—121	97—102	...
100,000	50	,,	12	12	Primitiva Ord.	5$\frac{1}{2}$—6	$\frac{1}{2}$—$\frac{1}{2}$	5/—6/—
1,450,345	5	29 Oct. 14	8	—	Do. 5 p.c. Pref.	4$\frac{1}{2}$—5	1$\frac{1}{2}$—1$\frac{1}{2}$	25/—25/6
2,499,800	5	30 Dec. 15	5	—	Do. 4 p.c. Deb.	91—93	70—74	...
341,400	100	June 1	4	4	Do. ,, ,, 1911	—	56—59	...
600,000	Stk.	July 26	4	4	Do. B. Aires 4 p.c. Deb.	85—87	56—59	55$\frac{7}{16}$—55$\frac{1}{2}$
220,535	,,	June 28	4	4	Do. Riv. Pl. 4 p.c. Deb.	85—87	56—59	...
521,670	,,	,,	4	4	San Paulo { 6 p.c. Pref.	10$\frac{1}{2}$—11	5$\frac{1}{2}$—6	...
150,000	10	Oct. 4	6	6	5 p.c. Deb.	47—49	38—41	...
125,000	50	July 2	5	5	Sheffield A	223—224	100—102*e*	101—101$\frac{1}{2}$
270,000	Stk.	Aug. 23	10	5	Do. B	222—224	100—102*e*	101
419,968	,,	,,	10	5	Do. C	220—222	100—102*e*	101
1,047,000	,,	,,	10	5	Shrewsbury 5 p.c.	—	..	...
133,201	Stk.	—	4	6	South African	10$\frac{1}{2}$—11$\frac{1}{2}$	7—9	...
90,000	10	Oct. 18	9	6	South Met. Ord.	111—113	97—99	97—98$\frac{1}{2}$
1,609,893	Stk.	July 26	5/9/4	5	Do. Red. Pref.	—	98—100	...
250,000	,,	July 12	—	5	Do. 3 p.c. Deb.	72$\frac{1}{2}$—74$\frac{1}{2}$	61—64	...
1,895,445	,,	,,	3	3	Do. 6$\frac{1}{2}$ p.c. Deb.	..	105—107	...
734,000	,,	Sept. 6	—	$6\frac{1}{2}$	South Shields Con. Stk.	157—159	134—136*d*	...
91,500	,,	Aug. 23	$8\frac{1}{2}$	$8\frac{1}{2}$	S'th Suburb'n Ord. 5 p.c.	114—116	100—103	102$\frac{1}{2}$
1,087,795	,,	,,	6	6	Do. 5 p.c. Deb. Stk.	116—118	97—102	...
568,837	,,	June 28	5	5	S'th'mpt'n Ord. 5p.c. max	99—102	86—89*	...
647,740	,,	Nov. 15	5	5	Do. 4 p.c. Deb. Stk.	..	76—81	...
121,275	,,	June 28	4	4	Swansea 7 p.c. Pref. Stk.	..	102—104	103$\frac{1}{2}$
250,000	,,	Aug. 23	—	7	Do. 6$\frac{1}{2}$ p.c. Deb. Stk.	..	105—107	105$\frac{1}{2}$
200,000	,,	June 28	—	$6\frac{1}{2}$	Tottenham District { A 5 p.c.	135—138	122—127	...
120,000	,,	July 26	—	8	B 3$\frac{1}{2}$ p.c.	115—117	100—105	102
782,275	,,	,,	6	$6\frac{1}{2}$	4 p.c. Deb.	87—89	78—82	...
181,255	,,	June 14	4	4	Tynemouth 5 p.c. max.	108$\frac{1}{2}$—109	89—91*d*	...
258,251	Stk.	Aug. 23	5	5	Wandsworth, Wimbledon, and Epsom—			
50,000	,,	July 12	$8\frac{1}{2}$	9	Wandsworth A 5 p.c.	151—156	140—145	...
255,636	,,	,,	$6\frac{1}{2}$	$7\frac{1}{2}$	Do. B 3$\frac{1}{2}$ p.c.	129—134	116—121	...
108,075	,,	,,	5/17/3	$6\frac{5}{16}$	Do. C.	110—115	100—105	...
140,865	,,	,,	—	$6\frac{5}{16}$	New Ordinary	..	..	...
352,000	,,	,,	$6\frac{1}{2}$	$7\frac{1}{2}$	Wimbledon 5 p.c.	117—122	110—115	...
98,000	,,	,,	$6\frac{1}{2}$	$7\frac{1}{2}$	Epsom 5 p.c.	121—126	118—123	...
88,416	,,	June 28	3	3	5 p.c Deb. Stk.	66—69	57—60	...

Quotations at:—*a.*—Bristol. *b.*—Liverpool. *c.*—Nottingham. *d.*—Newcastle. *e.*—Sheffield. * Ex div.

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Enniskillen Gas Price.—The Northern Ireland Ministry of Commerce have fixed the price of gas in Enniskillen at 10s. per 1000 c.ft. maximum, which, it is stated, will give interest of £3 19s. 7d. on the capital of the Gas Company.

Continental Union Gas Company, Ltd.—The Directors announce that a full dividend of 7 p.ct., less tax, will be payable on Jan. 2 next on the preference stock, for the year ended June 30, 1923, being an increase of 3 p.ct. on that paid for the year to June 30, 1922.

Another Reduction at Stratford upon-Avon.—The Gas Committee of the Stratford-upon-Avon Corporation recommended a further reduction of 4d. per 1000 c.ft. in price of gas after the present quarter, and this was confirmed by the Town Council at their meeting on the 9th inst. It is the second reduction this year, making a total of 11½d. per 1000 c ft.

Passing-off Creosote as "Solignum."—In the Chancery Division, before Mr. Justice Tomlin, an injunction was recently granted to Messrs. Major & Co., Ltd., restraining the Dorset Farmers, Ltd., from passing off as "Solignum" any goods not manufactured by the plaintiff Company. In August last a 10-gallon drum of creosote was dispatched under the name of "Solignum" by the defendant firm.

Youghal Gas Works.—The Irish Free State Local Government Department have sanctioned a loan of £2000 to enable the Youghal Urban District Council to effect much-needed improvements at the gas-works—stipulating that the money is to be obtained from the Provincial Bank of Ireland, and be repayable in five years, at ½ p.ct. below the Irish bank rate for the time, subject to a minimum of 4 p.ct.

Messrs. Joseph Evans & Sons (Wolverhampton), Ltd., inform us that they have changed their London Office to Craven House, Kingsway, W.C. 2.

At Beaumaris, during last week's heavy rainstorms, the gas-works furnaces were flooded, and the town experienced a night of darkness, but for lamps and candles.

During the Halifax Sunday Society's weekly lecture in the Victoria Hall the main electric fuse gave out, throwing the crowded hall into darkness for a quarter of an hour.

On behalf of the subscribers, a mayoral chain has been formally presented to Alderman A. H. Smith, J.P., the Mayor of Aldershot, by Dr. F. Stroyan, J.P., the Deputy-Chairman of the Aldershot Gas, Water, and District Lighting Company.

The Directors of Benzol and By-Products, Ltd., have decided that the Company's financial period shall terminate on Sept. 30. The net profit is estimated at about £48,000, while cash and investments in British Government securities are more than doubled in comparison with those set forth in the last accounts. Sir Alan Hutchings (a Director of the South Yorkshire Chemical Works, Ltd) has joined the Board. With regard to the outlook, trading shows a progressive increase.

On the occasion of the annual prize distribution at the Hastings Municipal School of Science, Mr. C. F. Botley gave an address on technical education, with particular reference to boilers and their economics. He said the present generation had tremendous advantages in learning science over those of former years. He remembered the time when practically the only place for scientific education was the London Polytechnic. He was one of those who thought that, if a child were given a fairly good grounding in all-round knowledge at one of the elementary schools, his proper education did not begin until he left. Hastings was at some disadvantage in giving a technical education, for it could by no means be called an industrial town.

Distribute the "GAS SALESMAN" Monthly Supplement

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E. B. SHARPLEY,
Town Clerk.
Town Hall, Stoke-on-Trent.
Nov. 21, 1923.

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Gas-Works, Stourbridge,
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North Street,
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